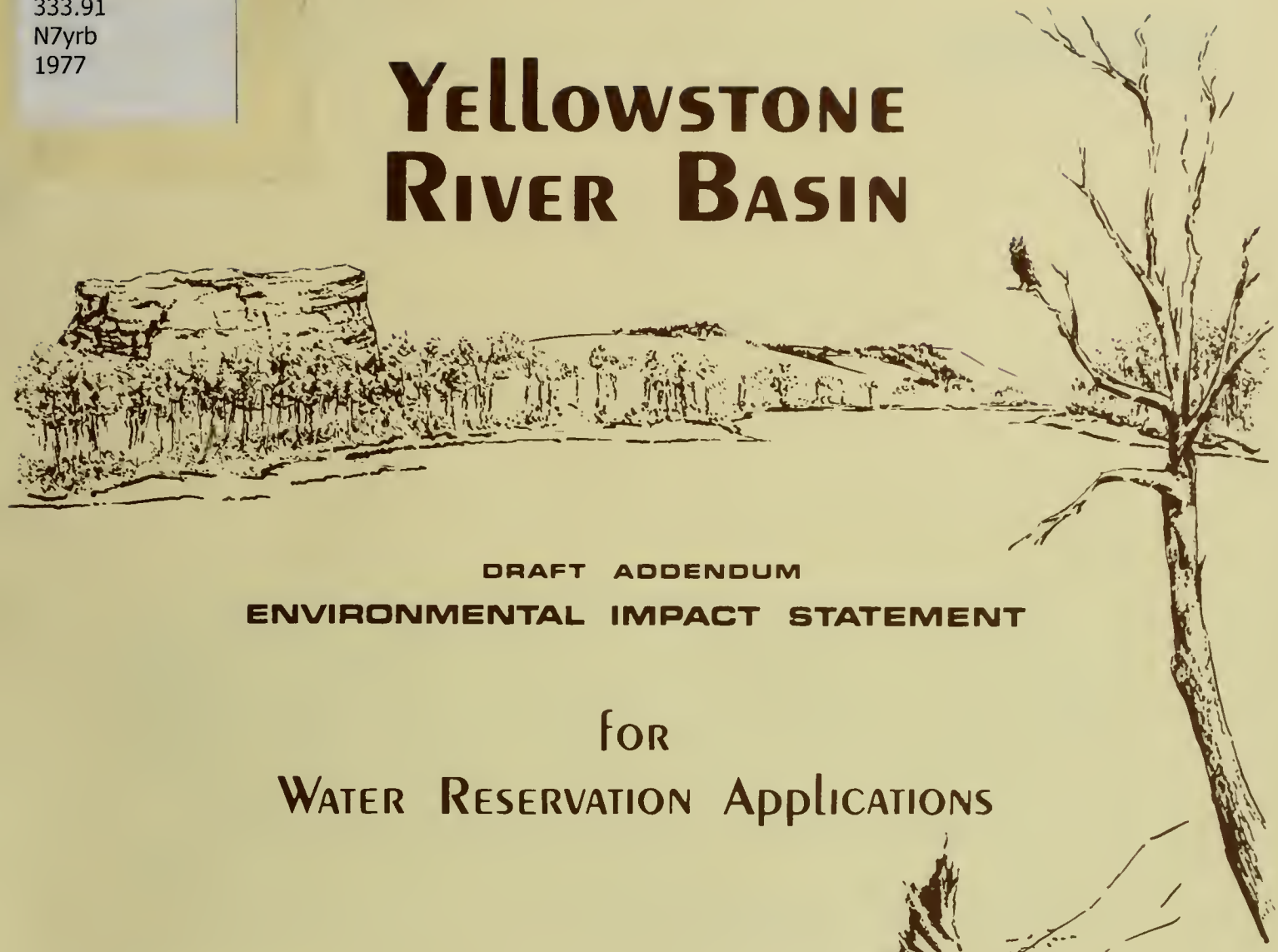
# YELLOWSTONE RIVER BASIN



## DRAFT ADDENDUM
## ENVIRONMENTAL IMPACT STATEMENT

## FOR
## WATER RESERVATION APPLICATIONS



MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

WATER RESOURCES DIVISION

JUNE 1977

DNRC

Thomas L. Judge, Governor

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

MEMBERS OF THE BOARD - CHAIRMAN CECIL WEEDING, DR WILSON F CLARK, VIOLA HERAK, WILLIAM BERTSCHE, DAVID G ORUM, ROY HUFFMAN CHARLES HASH

DNRC

John C. Orth, Director

June 15, 1977

The Addendum Draft Environmental Impact Statement (EIS) for Water Reservation Applications in the Yellowstone River Basin is transmitted herein. The addendum is necessary to consider additional impacts of new and amended water reservation applications not evaluated in the previously distributed Draft and Final Environmental Impact Statements. As an addendum, this document adopts and incorporates by reference the prior Draft and Final impact statements, as provided in MAC 36-2.2(6)-P250(2)(c).

Comments on the Addendum Draft EIS will be accepted until July 15, 1977, allowing 30 days for review from the date of transmittal to the Governor and Environmental Quality Council.

This Addendum Draft EIS was prepared in compliance with the Montana Environmental Policy Act, Section 69-6504(b)(3), R.C.M. 1947.

Sincerely,

Wayne A. Wetzel

WAYNE A. WETZEL
ENVIRONMENTAL COORDINATOR

WAW:ml

Enclosure

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# DRAFT ADDENDUM

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# WATER RESERVATION APPLICATIONS

# IN THE

# YELLOWSTONE RIVER BASIN

June 1977

Water Resources Division
MONTANA DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION
32 South Ewing
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# INTRODUCTION

## A HISTORY OF WATER RESERVATIONS IN MONTANA

The Montana Water Use Act of 1973 (Section 89-865 et seq. R.C.M. 1947) stipulates that state and federal agencies, as well as political subdivisions of the state, may apply to the Board of Natural Resources and Conservation (herein called the Board) to reserve water for existing or future beneficial uses or for maintenance of a minimum flow, level, or quality of water. Before an order reserving water may be adopted, the applicant must establish to the Board's satisfaction:

1) the purpose of the reservation
2) the need for the reservation
3) the amount of water necessary for the purpose of the reservation
4) that the reservation is in the public interest.

A water reservation, when adopted, becomes a water right. However, if objectives of the reservation are not being met, the Board can later modify that water right. In addition, if the use of the reserved water requires diversion or storage, progress must be shown, over time, towards completion of those facilities. Such progress is to follow a previously submitted plan.

The 1974 enactment of the Yellowstone Moratorium (Section 89-8-103 et seq. R.C.M. 1947) affected the reservation process in the Yellowstone Basin. Under the moratorium, all large applications (diversions of over 20 cfs or storage of over 14,000 af) for water use permits in the Yellowstone Basin were suspended until March 10, 1977, and applications for reservations in the basin by federal agencies were excluded until that date.

A substantial number of applications, all of which are primarily for industrial water use, were suspended. The language of the moratorium emphasized the need for reserving water in the Yellowstone Basin for the protection of existing and future beneficial water uses; particular emphasis was given to the reservation of water for agricultural and municipal needs, as well as guaranteed minimum flows for the protection of existing rights, future uses, water quality, and aquatic life. Any water reservation approved prior to approval of the suspended permit applications would have a preference of use over those permits.

During the moratorium, thirty water reservation requests were received for waters of the Yellowstone Basin; they are summarized in Table 1. Water for

TABLE 1

APPLICATIONS FOR RESERVATIONS OF WATER IN YELLOWSTONE BASIN

| Applicant | Source | Amount | Use |
|---|---|---|---|
| Park Conservation District | Yellowstone & Shields River | 752 cfs/108,143 acre feet per year (af/y) | Irrigation (36,570 acres) |
| Sweet Grass Conservation District | Yellowstone River, Boulder River & various tributaries | 438.7 cfs/55,822 af/y | Irrigation (18,510 acres) |
| Stillwater Conservation District | Yellowstone River & Stillwater River | 122.1 cfs/16,755 af/y | Irrigation (5,290 acres) |
| Carbon Conservation District | Yellowstone River, Clarks Fork, Rock Creek, Red Lodge Creek | 274.2 cfs/47,557 af/y | Irrigation (21,015 acres) |
| Yellowstone Conservation District | Yellowstone River | 378.2 cfs/62,900 af/y | Irrigation (26,785 acres) |
| Big Horn Conservation District | Big Horn River, Tongue River | 151 cfs/21,200 af/y | Irrigation (9,645 acres) |
| Treasure Conservation District | Yellowstone & Big Horn Rivers, Sarpy & Tullock Creeks | 129 cfs/19,978 af/y | Irrigation (7,645 acres) |
| Rosebud Conservation District | Yellowstone, Tongue Rivers, Armell's & Rosebud Creeks | 585 cfs/94,129 af/y | Irrigation (37,360 acres) |
| North Custer Conservation District[a] | Yellowstone River, Tongue River & Powder River | 732.4 cfs/104,237 af/y | Irrigation (36, 965 acres) |
| Powder River Conservation District[a] | Powder River, Tongue River, & various tributaries | 583.2 cfs/83,060 af/y | Irrigation (30,245 acres) |
| Prairie County Conservation District[a] | Yellowstone River | 512.9 cfs/63,127 af/y | Irrigation (20,646 acres) |
| Dawson County Conservation District[a] | Yellowstone River | 325 cfs/45,149 af/y | Irrigation (17,897 acres) |
| Richland County Conservation District | Yellowstone River | 354.2 cfs/45,620 af/y | Irrigation (21,710 acres) |
| Huntley Project Irrigation District | Yellowstone River | 92 cfs/27,372 af/y | Irrigation (4,000 acres) |
| Buffalo Rapids Irrigation Project | Yellowstone River | 167 cfs/124,434 af/y | Irrigation (41,306 acres) |
| Department of State Lands | Numerous tributaries in Yellowstone Basin | 15,078 af/y | Irrigation (10,270 acres) |
| Department of State Lands | Numerous tributaries in Yellowstone Basin | 143.64 cfs/21,429 af/y | Irrigation (7,143 acres) |
| Department of State Lands | Numerous tributaries in Yellowstone Basin | 218.03 cfs/30,898 af/y | Irrigation (10,376 acres) |
| City of Livingston | Yellowstone River | 20.8 cfs/15,060 acre feet per year (af/y) | Domestic, Municipal |
| City of Big Timber | Yellowstone River | 6.19 cfs/4,483 af/y | Domestic, Municipal |
| City of Columbus | Yellowstone River | 3.6 cfs/2,606 af/y | Domestic, Munidipal |
| City of Laurel | Yellowstone River | 23.2 cfs/16,830 af/y | Domestic, Municipal |

[a] Application subsequently amended, as presented in Table 2

TABLE 1 continued

| Applicant | Source | Amount | Use |
|---|---|---|---|
| City of Billings | Yellowstone River | 1,190 cfs/317,456 af/y | All Beneficial Uses |
| City of Miles City | Yellowstone River | 30 cfs/21,720 af/y | Municipal |
| Town of Broadus | Ground Water | 0.84 cfs/605 af/y | Municipal |
| City of Glendive | Yellowstone | 17.62 cfs/12,756.9 af/y | Domestic, Municipal |
| Department of Natural Resources and Conservation[b] | Tongue River | 450,000 acre-feet (af) | Irrigation, Industrial, Fish & Wildlife |
| Department of Natural Resources and Conservation[c] | Powder River & tributaries | 1,150,000 af | Irrigation, Industrial, Fish & Wildlife |
| Montana Fish and Game Commission | Yellowstone Basin and numerous tributaries | Variable monthly flows; 8,206,723 af/y for Yellowstone River at Sidney | Water Quality, Fish & Wildlife, Recreation |
| Department of Health and Environmental Sciences | Yellowstone River | 6,643,000 af/y for Yellowstone River at Sidney | Water Quality |

[b] Application remains the same, however, supplemental information available since publication of the previous EIS's is presented in this addendum.

[c] Application withdrawn.

future irrigation consumption was requested by 13 conservation districts, two irrigation districts, and the Department of State Lands; water for domestic or municipal consumption was requested by eight municipalities; multipurpose requests were submitted by the Department of Natural Resources and Conservation (DNRC). Nonconsumptive uses, i.e. instream flow purposes, were requested in two major applications submitted by the Montana Fish and Game Commission and the Department of Health and Environmental Sciences. In addition, instream flow purposes were mentioned in all the conservation district applications.

In December of 1976, a two-volume draft environmental impact statement (EIS) was published by the DNRC (Yellowstone River Basin: Draft Environmental Impact Statement for Water Reservation Applications). In February of 1977, the Final EIS was released. At that time, it was still expected that the Board would rule on the reservation applications by March 10. However, due to procedural delays for hearings to be held under the Water Use Act, the Board was not able to act on the pending applications by the March 10 moratorium expiration. In recognition of this, the 45th Montana Legislature passed and the Governor signed legislation extending the Yellowstone Moratorium to allow time for completion of the hearings. The extension will expire on January 1, 1978, unless the Board acts on the requests before that date or the proceedings are delayed by litigation; in the latter case, the moratorium may be extended by court order until January 10, 1979. Another new law now allows the federal government to apply for water reservations in the basin.

## NEW AND AMENDED APPLICATIONS

Following the extension of the moratorium, new water reservation applications were received, some earlier applications were amended, and one was withdrawn. These new and amended applications are summarized in Table 2.

Subsequent to additional analysis of land and water resources of their counties, North Custer, Powder River, Prairie County, and Dawson County conservation districts have increased their requests for irrigation water.

DNRC has also completed additional studies on its Tongue River application. This supplemental information and its implications are also discussed in this addendum.

One application, DNRC's request on the Powder River involving construction of Moorhead Dam, has been withdrawn following additional feasibility studies which showed that water quality problems would probably result from building Moorhead Dam and from the depleted streamflows which would result.

As a result of the moratorium extension and of an amendement allowing the federal government to apply for water reservations in the Yellowstone River Basin, the Board received new reservation applications from the Bureau of Reclamation, Bureau of Land Management (BLM), and the Little Beaver Conservation District. This addendum will consider the impacts of these additional and amended reservation requests and the cumulative effects of all applications.

TABLE 2

NEW AND AMENDED WATER RESERVATION APPLICATIONS

| Applicant | Source | Amount | Use |
|---|---|---|---|
| AMENDED APPLICATIONS[a] | | | |
| North Custer Conservation District | Powder River and Yellowstone River | 6,026 acre-feet per year (af/y) | Irrigation |
| Powder River Conservation District | Powder River | 4,120 af/y | Irrigation |
| Prairie County Conservation District | Powder River and Yellowstone River | 5,192 af/y | Irrigation |
| Dawson County Conservation District | Yellowstone River | 706 af/y | Irrigation |
| NEW APPLICATIONS | | | |
| Bureau of Land Management | Yellowstone River and numerous tributaries | variable monthly instream flows, 200 cfs for Yellowstone River; 21,498 af/y for irrigation | Livestock and wildlife watering, fish & wildlife, irrigation |
| Bureau of Reclamation | Yellowstone River | 68,700 af/y | Municipal, industrial, recreation, fish & wildlife |
| Bureau of Reclamation | Yellowstone River | 121,800 af/y | Municipal, industrial, recreation, fish & wildlife |
| Bureau of Reclamation | Yellowstone River | 539,000 af/y | Municipal, industrial, recreation, fish & wildlife |
| Bureau of Reclamation | Bighorn River | 131,700 af/y | Irrigation |
| Little Beaver Conservation District | O'Fallon, Pennel, & Cabin creeks | 25,546 af/y | Irrigation, recreation |

[a] Amounts shown are increases over original application

## NATURE OF THIS ADDENDUM

Any proposed action within the state which is major, may significantly affect the quality of the human environment, or is controversial requires preparation of an environmental impact statement under the Montana Environmental Policy Act (MEPA) guidelines adopted by the Montana Environmental Quality Council and rules adopted by both the Board of Natural Resources and Conservation and DNRC. The purpose of the EIS is to examine the potential consequences of the proposed action, present alternatives, inform the public, and guide the Board in its deliberations.

This addendum to the Draft and Final EIS's addresses the cumulative impacts of additions and changes to those water reservation applications considered previously. As an addendum, it adopts the Draft and Final EIS's in their entirety, excepting any specific changes from the original documents made in this addendum. Referral to those documents is necessary for a complete understanding of this addendum.

## HEARINGS ON THE WATER USE ACT

This addendum, like the Draft and Final EIS's, contains no recommendations from DNRC to the Board of Natural Resources and Conservation regarding action on the water reservation applications. Before the Board can act on the water reservation applications, hearings, required by the Montana Water Use Act, will be held in Billings. At the conclusion of these hearings, all parties to the reservation process (applicants and objectors) will be given the opportunity to submit findings of fact, conclusions of law, and a proposed order to the Board for consideration. The Board will, after receipt of this information from all parties, close the record and, based upon that record, act on the reservation applications. The hearings have been set by the Hearing Examiner to begin on August 8, 1977.

# AMENDED WATER RESERVATION APPLICATIONS AND ASSOCIATED IMPACTS

Amended requests include those from North Custer, Powder River, Prairie County, and Dawson County conservation districts. For more detailed descriptions of the original applications, see Part III of the Draft EIS. Because DNRC submitted supplemental information to its Tongue River request, that application is also analyzed here. Map 1 shows the approximate locations of additional irrigable lands associated with these amendments.

## CONSERVATION DISTRICT APPLICATIONS

### Description of Applications

#### NORTH CUSTER CONSERVATION DISTRICT

The conservation district has identified an additional 1,230 acres of land feasible for irrigation using water from the Yellowstone River. There would be an additional 700 acres of land irrigated by flood, 160 by sideroll, and the remaining 370 by center pivot. This increases the district's earlier application for diversion in the Yellowstone Basin by 3,441 af/y, and for depletion, by 2,412 af/y.

The district has also identified an additional 2,585 acres of land suitable for water spreading using the Powder River as a water source. Irrigation of this land would require an additional 2,585 af/y. Table 3 summarizes North Custer Conservation District's reservation application as modified.

TABLE 3

SUMMARY OF IRRIGABLE ACRES, WATER DIVERSION, AND WATER DEPLETION:
NORTH CUSTER CONSERVATION DISTRICT
RESERVATION APPLICATION

| Drainage Basin | Type of Irrigation | Acreage | Diversion (af/y) | Depletion [a] (af/y) |
|---|---|---|---|---|
| Yellowstone [b] [c] | Flood | 1,910 | 6,246 | 3,748 |
| | Sideroll | 480 | 1,046 | 941 |
| | Center Pivot | 5,050 | 11,009 | 9,908 |
| SUBTOTAL | | 7,440 | 18,301 | 14,597 |
| Tongue | Flood | 695 | 2,295 | 1,376 |
| | Sideroll | 680 | 1,496 | 1,322 |
| | Center Pivot | 3,230 | 7,106 | 6,395 |
| SUBTOTAL | | 4,605 | 10,897 | 9,093 |
| Powder [d] | Flood | 17,000 | 57,800 | 34,680 |
| | Sideroll | 1,850 | 4,180 | 3,760 |
| | Center Pivot | 7,300 | 16,500 | 14,850 |
| | Water Spreading | 2,585 | 2,585 | unknown |
| SUBTOTAL | | 28,735 | 81,065 | |
| TOTALS | | 40,780 | 110,263 | |

[a]Assumed to be 60 percent of the flood diversion and 90 percent of the sprinkler diversion

[b]Includes 250 acres of unspecified development within Tongue and Yellowstone River Irrigation District

[c]Excludes 290 acres of state land within projects

[d]Excludes 1,400 acres of federal land and 950 acres of state land within projects

# Yellowstone River Basin

## New or Amended Applications for Water Reservations Consumptive Use Only

- ①Conservation Districts Irrigation
- Bureau of Land Management Irrigation
- Bureau of Reclamation Irrigation
- Department of Natural Resources Irrigation
- Bureau of Reclamatiom Offstream Storage Site

① In addition Powder River, Custer, and Prairie County conservation districts applied for water spreading but did not identify specific locations.

SOURCE: Derived from applications received

0 10 20 40 60 80 100 Miles

0 10 20 30 40 50 60 70 80 90 100 Kilometers


N

SIDNEY
RICHLAND
McCONE
DAWSON
GLENDIVE
GARFIELD
PRAIRIE
WIBAUX
NORTH DAKOTA
Sundoy Creek Reservoir
O'Fallon Creek
FALLON
Cedor Ridge Reservoir
MILES CITY
MUSSELSHELL
TREASURE
Yellowstone River
MEAGHER
WHEATLAND
GOLDEN VALLEY
Buffolo Creek Reservoir
ROSEBUD
CUSTER
SWEET GRASS
YELLOWSTONE
COLSTRIP
Tongue River
Rosebud Creek
BILLINGS
HARDIN
Little Bighorn River
Shields River
Boulder River
Stillwater River
Yellowstone River
GALLATIN
LIVINGSTON
PARK
STILLWATER
CROW
INDIAN
NORTHERN CHEYENNE INDIAN RESERVATION
ASHLAND
POWDER RIVER
CARTER
BROADUS
Powder River
Little Powder River
SOUTH DAKOTA
Pryor Creek
Clarks Fork Yellowstone R.
Sage Cr.
BIG HORN RESERVATION
Yellowtail Reservoir
Bighorn River
CARBON
YELLOWSTONE NATIONAL PARK
WYOMING

Map 1

POWDER RIVER CONSERVATION DISTRICT

According to the application, the conservation district has identified 4,120 additional acres within the county which, considering both engineering and economics, should become feasible for future water spreading using the Powder River as a source of supply. The diversion requirement is estimated to be one acre-foot per acre. Table 4 summarizes the Powder River Conservation District's reservation request as modified.

TABLE 4

SUMMARY OF IRRIGABLE ACRES, WATER DIVERSION, AND WATER DEPLETION: POWDER RIVER CONSERVATION DISTRICT RESERVATION APPLICATION

| Drainage Basin | Type of Irrigation | Acreage | Diversion (af/y) | Depletion [a] (af/y) |
|---|---|---|---|---|
| Powder | Flood | 20,200 | 68,680 | 41,200 |
| | Sideroll | 2,000 | 4,500 | 4,050 |
| | Center Pivot | 3,045 | 6,880 | 6,200 |
| SUBTOTAL | | 25,245 | 75,560 | 51,450 |
| | Water Spreading | 9,120 | 11,620 | Unknown |
| TOTAL | | 34,365 | 87,180 | |

[a]Assumed to be 60 percent of the flood diversion and 90 percent of the sprinkler diversion

POWDER RIVER CONSERVATION DISTRICT

According to the application, the conservation district has identified 4,120 additional acres within the county which, considering both engineering and economics, should become feasible for future water spreading using the Powder River as a source of supply. The diversion requirement is estimated to be one acre-foot per acre. Table 4 summarizes the Powder River Conservation District's reservation request as modified.

TABLE 4

SUMMARY OF IRRIGABLE ACRES, WATER DIVERSION, AND WATER DEPLETION: POWDER RIVER CONSERVATION DISTRICT RESERVATION APPLICATION

| Drainage Basin | Type of Irrigation | Acreage | Diversion (af/y) | Depletion [a] (af/y) |
|---|---|---|---|---|
| Powder | Flood | 20,200 | 68,680 | 41,200 |
| | Sideroll | 2,000 | 4,500 | 4,050 |
| | Center Pivot | 3,045 | 6,880 | 6,200 |
| SUBTOTAL | | 25,245 | 75,560 | 51,450 |
| | Water Spreading | 9,120 | 11,620 | Unknown |
| TOTAL | | 34,365 | 87,180 | |

[a]Assumed to be 60 percent of the flood diversion and 90 percent of the sprinkler diversion

PRAIRIE COUNTY CONSERVATION DISTRICT

The conservation district has identified three additional units (totaling 1,595 acres) within the county that should become feasible for irrigation. The additional acreage would be flood irrigated using water from the Yellowstone River. An additional 295 af/y is also requested from the Powder River to use for water spreading on 295 acres of land not previously identified. Table 5 summarizes the Prairie County Conservation District reservation application as modified.

TABLE 5

SUMMARY OF IRRIGABLE ACRES, WATER DIVERSION, AND WATER DEPLETION: PRAIRIE COUNTY CONSERVATION DISTRICT RESERVATION APPLICATION

| Drainage Basin | Type of Irrigation | Acreage [a] | Diversion (af/y) | Depletion[b] (af/y) |
|---|---|---|---|---|
| Yellowstone | Flood | 21,929 | 67,322 | 40,393 |
| | Center Pivot | 312 | 702 | 632 |
| TOTAL | | 22,241 | 68,024 | 41,025 |
| Buffalo Rapids Irrigation District[c] | Flood | 3,316 | 10,180 | 6,108 |
| Powder | Water Spreading | 295 | 295 | Unknown |

[a]Excludes 532 acres of state lands and 482 acres of federal lands

[b]Assumed to be 60 percent of the flood diversion and 90 percent of the sprinkler diversion.

[c]Acreage included in Prairie County Conservation District reservation request in or adjacent to Buffalo Rapids Irrigation District

DAWSON COUNTY CONSERVATION DISTRICT

The conservation district has identified 230 additional acres within the county which, considering both engineering and economics, could become feasible for future irrigation, most likely flood irrigation using water from the Yellowstone River. Table 6 summarizes the Dawson County Conservation District reservation request as modified.

TABLE 6

SUMMARY OF IRRIGABLE ACRES, WATER DIVERSION, AND WATER DEPLETION:
DAWSON COUNTY CONSERVATION DISTRICT
RESERVATION APPLICATION

| Drainage Basin | Type of Irrigation | Acreage [a] | Diversion (af/y) | Depletion [b] (af/y) |
|---|---|---|---|---|
| Yellowstone | Flood | 6,182 | 18,979 | 11,387 |
| | Sideroll | 920 | 2,070 | 1,863 |
| | Center Pivot | 11,025 | 24,806 | 22,325 |
| TOTAL | | 18,127 | 45,855 | 35,575 |
| Buffalo Rapids Irrigation District [c] | Flood | 2,980 | 9,149 | 5,489 |
| | Center Pivot | 260 | 585 | 351 |
| TOTAL | | 3,240 | 9,734 | 5,840 |

[a]Excludes 1,932 acres of state land

[b]Assumed to be 60 percent of the flood diversion and 90 percent of the sprinkler diversion

[c]Acreage included in Dawson County Conservation District's reservation request on or adjacent to Buffalo Rapids Irrigation District

## Environmental Impacts--Amended Conservation District Applications

This section considers the environmental impacts that would result from the amended conservation district applications. Because only the North Custer, Powder River, Prairie County, and Dawson County conservation district applications are amended, impact projections presented in the Draft EIS (pp. 153-165) are not affected except in the Powder and Lower Yellowstone subbasins. The reader is referred to the discussion of impacts in the Draft EIS for those conservation district applications that will not be changed by these amendments.

Impacts associated with those amendments are presented below.

### PRIMARY IMPACTS

Streamflow Alteration. Diversion for the irrigable lands added to or changed from the original applications in the Powder and Lower Yellowstone subbasins will not cause streamflow alterations significantly different from those identified in the Draft EIS on pages 153 and 256.

Channel Form. Impacts on channel form will be unchanged from those identified on pages 153, 256, and 278 of the Draft EIS, in which it is assumed that a dam will be built on the Powder River. DNRC's application, which involved the building of Moorhead Dam, has been withdrawn; however, implementation of the Powder River and North Custer conservation districts' applications would require a large amount of water storage on the Powder River.

Water Quality. The amended applications incorporate new acreage primarily by increasing water-spreading irrigation systems using only high spring flows, which generally have the best water quality in terms of alkalinity and salinity. The amount of additional acreage in all cases is so small that additional water-quality problems not previously addressed are unlikely.

Ecosystems. Impacts discussed on pages 154 and 283 of the Draft EIS would not be changed by implementation of the amended applications.

### SECONDARY IMPACTS

Socioeconomics. Board approval of the amended applications would have the effect of securing water supplies for future irrigation. Additional acreage, hence additional water use, would be relatively small. The impacts of continued and increased agricultural water use discussed on pages 154 to 156, 283, and 284 of the Draft EIS would not be significantly changed by the conservation district amendments.

Municipal and Domestic Water Use. The amendments will not affect water quality or quantity for existing or potential municipal water systems in the Lower Yellowstone Subbasin.

Recreation and Aesthetics. The beneficial and adverse effects of increased irrigation on recreation and aesthetics would not be different from those previously described in the Draft EIS (pp. 157 and 284).

Historical-Archeological. No known sites would be disrupted or damaged in irrigating the acreage added by the amended applications.

## DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION APPLICATIONS

### Description of Amended Applications

The Department has provided supplemental information for inclusion in its application on the Tongue River.

The application proposes raising the existing dam, which would increase the firm yield of the existing Tongue River reservoir by 58,000 af/y. Of that increase, 29,250 af/y of water have been assumed for irrigation of 13,000 acres of land adjacent to the Tongue River, 5,346 acres in Rosebud County and the remaining 7,654 acres in Custer County. Of the lands to be irrigated, 1,213 acres are Class I, 8,008 are Class II, and 3,779 are Class III. (See p. 45 of the Draft EIS for a definition of land classes.) The cropping pattern projected for the new lands is: hay, 85 percent; silage, 10 percent; and grain, 5 percent. The remaining 28,750 af/y of water has been assumed for sale for industrial purposes. The project would provide for other uses such as flood control and recreation.

In addition, the DNRC withdrew its water reservation application for the Powder River.

### Environmental Impacts--DNRC Tongue River Application

PRIMARY IMPACTS

Streamflow Alteration. Figure 1 shows the effect of the DNRC application, if implemented, on the monthly outflows of the Tongue Subbasin. Median flows would be significantly reduced in all months except June. The median July flow would be reduced by over half.

Channel Form. Despite these significant flow reductions in most months, the river channel would probably change little, for it has already undergone a major change due to the construction of the existing dam. Because of reduced flows, however, vegetation would tend to encroach on the channel.

Water Quality. TDS concentrations in the Tongue River already exceed 500 milligrams per liter (mg/l) two-thirds of the year, and average over 700 mg/l during December and January. Salinity would increase under the DNRC development. As shown in table 7, TDS levels would average over 1,000 mg/l in July, August, and September; for 90th percentile low flows, TDS concentrations would exceed 1,000 mg/l in June, July, August, September, and October. See pp. 55 and 56 in the Draft EIS for a discussion of irrigation and fishery salinity standards.

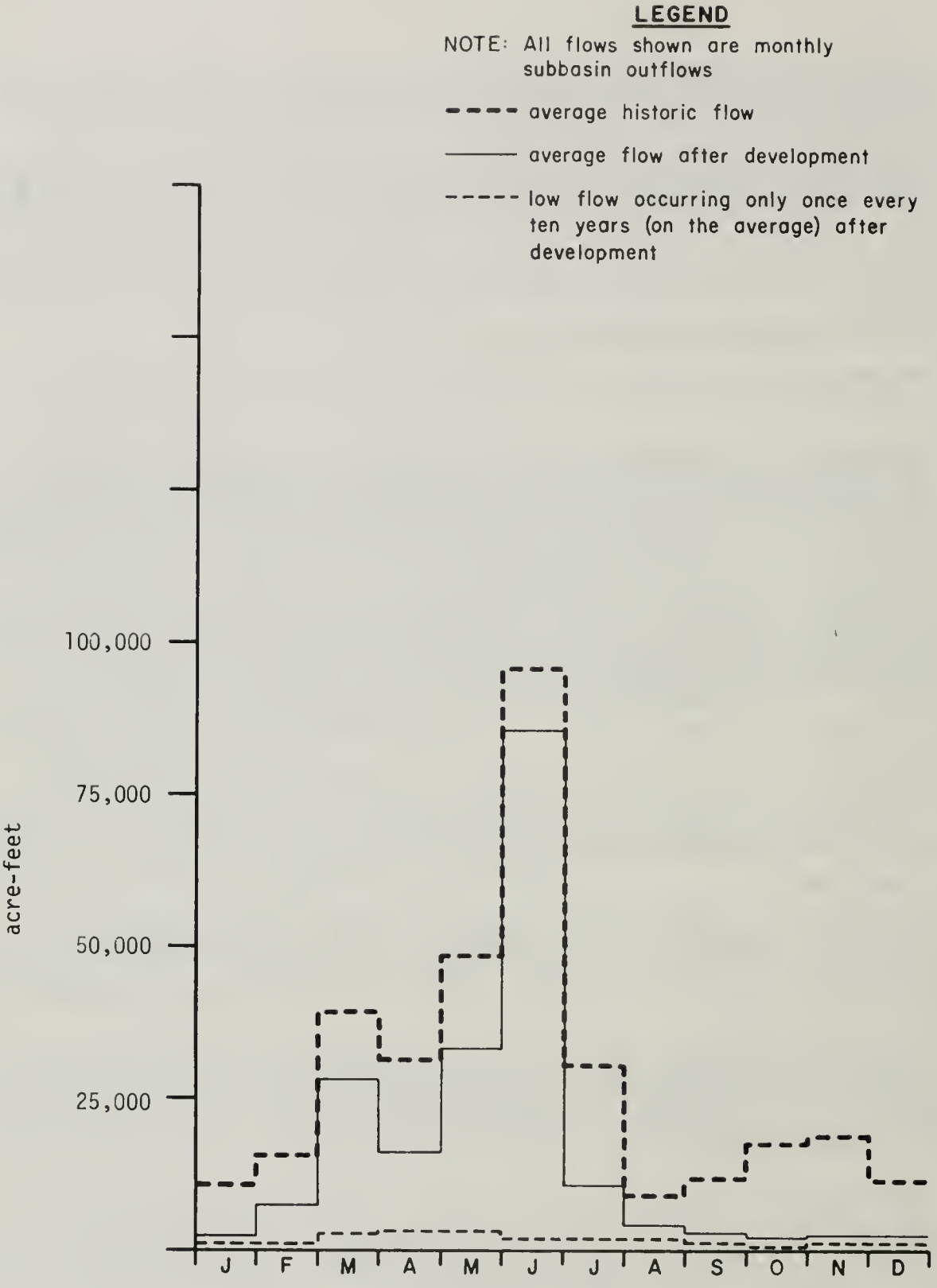



FIGURE 1. Tongue Subbasin Monthly Outflows for DNRC Application

TABLE 7

MONTHLY OUTFLOWS AND TOTAL DISSOLVED SOLIDS, TONGUE SUBBASIN, DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION APPLICATION

| | 50TH-PERCENTILE FLOW | | | | 90TH-PERCENTILE LOW FLOW | | | |
|---|---|---|---|---|---|---|---|---|
| | Historical | | Simulated | | Historical | | Simulated | |
| | Discharge (af) | TDS (mg/l) | Discharge (af) | TDS (mg/l) | Discharge (af) | TDS (mg/l) | Discharge (af) | TDS (mg/l) |
| Jan | 10,266 | 700 | 1,190 | 696 | 8,114 | 740 | 1,190 | 776 |
| Feb | 11,882 | 596 | 1,090 | 613 | 6,385 | 670 | 1,090 | 692 |
| Mar | 28,228 | 480 | 6,615 | 499 | 13,524 | 548 | 2,990 | 599 |
| Apr | 24,569 | 570 | 7,765 | 497 | 8,923 | 665 | 3,090 | 630 |
| May | 43,154 | 459 | 22,888 | 496 | 12,479 | 563 | 3,770 | 836 |
| Jun | 82,096 | 291 | 73,325 | 415 | 13,564 | 440 | 2,260 | 1,205 |
| Jul | 25,204 | 368 | 2,650 | 1,105 | 3,135 | 604 | 2,650 | 1,279 |
| Aug | 7,746 | 509 | 2,650 | 1,164 | 1,107 | 265 | 2,050 | 1,297 |
| Sep | 11,541 | 501 | 1,870 | 1,002 | 1,190 | 800 | 1,870 | 1,116 |
| Oct | 14,569 | 540 | 1,680 | 932 | 2,152 | 762 | 1,680 | 1,032 |
| Nov | 17,490 | 590 | 1,390 | 806 | 5,533 | 760 | 1,390 | 901 |
| Dec | 12,356 | 703 | 1,290 | 756 | 6,332 | 820 | 1,290 | 844 |

Reduced streamflows would decrease the sediment transport capacity of the river. However, sediment available for transport would also be reduced. The bed of the river is presently armored with large particles not subject to erosion. Finer, erodible particles in the banks would not be accessible to the reduced flows, especially after vegetation encroaches further into the channel.

Ecosystems. Virtually all aquatic organisms would suffer adverse impacts from the flow and water-quality changes which would result under the DNRC application.

The species composition of periphyton and macroinvertebrate communities would change, reflecting the competitive advantage of those tolerating higher salinities and temperatures as well as fluctuating concentrations of dissolved oxygen.

The basin outflows following construction of this project would be less than those needed for spawning, rearing, and wintering of the existing fishery. Species composition would change, with the possible elimination of such migratory species as sauger and shovelnose sturgeon. Channel catfish, smallmouth bass, and some nongame fish might not be able to tolerate the poor water quality. The fish population level would be reduced because of the loss of suitable habitat.

The present lack of islands in the Tongue River limits the nesting ability of Canada geese. Flow reductions such as those which would result if this application were implemented would increase predators' access to goose nests, decreasing (or eliminating) the already low goose population. At present, more ducks than geese can be found along the Tongue, but major flow reductions would reduce the habitat available to ducks as well. However, the increase in irrigation could attract migratory waterfowl.

Major impacts to beaver have already occurred with the construction of Tongue River Dam and the subsequent loss of river islands and backwater areas. Further encroachment of vegetation on the river channel would increase the food supply for beavers until vegetation approached the expected cottonwood climax, at which time the food supply would be reduced. Lower flows in winter could also result in the freezing of beaver caches and muskrat feedbeds and the exposure of these animals to both predation and thermal stress.

Increased reservoir size would provide additional habitat for fish species currently living in Tongue River Reservoir and result in an increased fish population.

## SECONDARY IMPACTS

Socioeconomic. The increase in income which would result from the project can be divided into direct benefits and indirect benefits. Direct benefits are the increases in net income (or in the value of the benefits) to the primary beneficiaries. These beneficial effects were listed in the benefit-cost analysis submitted with the reservation application. Indirect benefits were estimated by using input-output-type multipliers developed by the Water Resources Council (WRC 1977). These multipliers are used to estimate the increases in indirect benefits--regional income that would be induced by increased spending by project beneficiaries and those that stem from increased business in the sectors that process the outputs.

Table 8 lists estimated direct, indirect, and total increases in regional income which would result from the DNRC project; table 9 shows costs. The WRC multipliers are estimated for a region that includes Montana's part of the Yellowstone Basin plus Gallatin, Musselshell, Garfield, McCone, Carter, Fallon, and Wibaux counties.

TABLE 8

ESTIMATED BENEFITS OF DNRC PROPOSED PROJECT

| Type of Benefits | Direct Benefits | Indirect Benefits | Total Benefits |
|---|---|---|---|
| Irrigation | $1,062,200 | $4,736,600 | $ 5,798,800 |
| Industrial | 4,115,600 | 2,872,700 | 6,988,300 |
| Flood Control | 91,900 | 111,800 | 203,700 |
| Recreation | 100,000 | 0 | 100,000 |
| Fish and Wildlife | 100,000 | 0 | 100,000 |
| Land Conservation | 40,400 | 49,200 | 89,600 |
| Power | 510,900 | 259,100 | 770,000 |
| TOTAL BENEFITS | $6,021,000 | $8,029,400 | $14,050,400 |

TABLE 9

ESTIMATED COSTS OF DNRC PROPOSED PROJECT

| | |
|---|---|
| COSTS | |
| Installation | $49,235,000 |
| Interest During Construction | $ 5,000,390 |
| TOTAL PROJECT COSTS | $54,235,390 |
| Annual Equivalent Value | $ 3,622,000 |
| Benefit-Cost Ratio = 1.66:1 | |

The estimated regional increases in income due to the project will be largely offset by income declines elsewhere in this and neighboring regions because the indirect benefits are primarily transfers. No estimate of these offsetting declines is possible, but it is likely that most of them will occur within the Yellowstone Basin; therefore, the net increase in income within the region would not be much above the net direct benefits of the project.

Reconstruction of the Tongue Dam would have a substantial employment impact. The Bureau of Reclamation estimates that 22.8 jobs are created for every million dollars per year spent on construction, 60 percent of them on-site and 40 percent off-site. Table 10 shows the estimates of the annual employment impact for each of the four years required for construction.

TABLE 10

EMPLOYMENT IMPACT OF DNRC PROPOSED PROJECT

| YEAR | NUMBER OF ON-SITE JOBS | NUMBER OF OFF-SITE JOBS | TOTAL |
|---|---|---|---|
| 1 | 51 | 34 | 85 |
| 2 | 167 | 112 | 279 |
| 3 | 247 | 166 | 413 |
| 4 | 206 | 138 | 344 |

During the construction period, the on-site employees can be expected to live in Sheridan. The impact of the increased employment on public services in Sheridan can't be adequately determined now because the percentage of workers who will be prior residents of Sheridan and the percentage who will move in from other areas have not been estimated.

The estimated costs for energy are included in the estimated construction costs.

Municipal and Domestic Water Use. Implementation of this application would not affect current or potential municipal water systems.

Recreation and Aesthetics. The existing seminatural, semipastoral valley could become more industrialized and urbanized. Land-use patterns, which historically have reflected both agriculture and wildlife habitat, would be partially converted to irrigated cropland, with a resulting loss of habitat for some wildlife species. This increased irrigation should attract increasing numbers of migratory waterfowl. Wildlife habitat would also be lost through inundation of about 5,000 additional acres by the enlarged reservoir. Some of that loss may occur regardless of project construction, since strip mining of coal is expected for portions of that area.

Recreation opportunities that emphasize natural surroundings would diminish due to fish and wildlife habitat destruction, alteration of aesthetics, and increased human population. On the other hand, flat-water recreation opportunities would increase.

Environmental Impacts--DNRC Withdrawal of Powder River Application

Withdrawal of the DNRC water reservation will not affect development in the Powder River Basin. The Powder River and North Custer conservation districts assume storage on the Powder River to satisfy a portion of their water reservation requests. While it is doubtful that those conservation districts could construct a project the size of the Moorhead Reservoir, they could perhaps purchase water if a federal water development agency built a project similar to Moorhead Reservoir.

Environmental effects due to DNRC's construction of the Moorhead Project (see p. 177 of the Draft EIS) will not occur; however, similar effects would occur if private or federal entitites were to build a similar project.

## NEW WATER RESERVATION APPLICATIONS AND ASSOCIATED IMPACTS

New applications are those from the Bureau of Land Management (BLM), the Bureau of Reclamation, and the Little Beaver Conservation District.

### BUREAU OF LAND MANAGEMENT

Part of the BLM request is for water for livestock and wildlife and for instream flows to support riparian habitats for 40 streams in the basin. Table 11 summarizes this part of BLM's request. The amount in acre-feet per year (af/y) represents livestock and wildlife consumption, while the amount in cubic feet per second (cfs) is the instream flow request. Streams included in the request are shown on Map 2 for the entire basin and Map 3 for the Powder River Basin.

In addition, 21,298 af/y for irrigation was included in the BLM request (Table 12). See Map 1 for approximate location of these lands.

The environmental impacts of the two types of water use applied for -- irrigation (consumptive) and instream -- are discussed separately below.

#### Environmental Impacts -- BLM Irrigation Request

No immediate environmental impact would result from the implementation of the irrigation reservation request. The impacts to the natural and cultural environments described below would occur, in time, as the reserved water is gradually put to irrigation use over a period of years. The same impacts might result following denial of each reservation application, since the irrigation might eventually be developed under water use permits.

##### PRIMARY IMPACTS

Streamflow Alterations. The lands proposed to be irrigated in the application would be served by the Yellowstone and Powder rivers and O'Fallon Creek. The supply in these streams is generally adequate to serve the needs of the proposed projects without causing significant streamflow alterations.

Channel Form. No significant changes in channel form are expected to result for the implementation of this request.

TABLE 11

BUREAU OF LAND MANAGEMENT RESERVATION REQUEST FOR MAINTENANCE OF RIPARIAN HABITAT, LIVESTOCK, AND WILDLIFE USES

| Planning Subbasin | Source | Livestock and Wildlife Use Amount | |
|---|---|---|---|
| | | af/y | cfs |
| Upper Yellowstone | Boulder River | 0.53 | 25 |
| | Bridger Creek | 0.22 | 5 |
| | Stillwater River | 0.62 | 25 |
| | Upper Deer Creek | 0.10 | 5 |
| | Lower Deer Creek | 0.28 | 5 |
| | Yellowstone River | 2.4 | 200 |
| Clarks Fork Yellowstone | Clarks Fork Yellowstone River | 3.8 | 25 |
| | Bluewater Creek | 0.71 | 5 |
| | Bear Creek | 0.60 | 5 |
| | Cottonwood Creek | 0.41 | 5 |
| | Five Mile Creek | 0.37 | 5 |
| Bighorn | Sage Creek | 4.6 | 5 |
| | Crooked Creek | 0.67 | 5 |
| Tongue River | Tongue River | 0.483 | 130 |
| Powder River | Powder River | 4.55 | 200 |
| | Mizpah Creek | .574 | 3 |
| | Sheep Creek | 0.63 | 3 |
| | N. F. Sheep Creek | 1.288 | 3 |
| | S. F. Sheep Creek | .224 | 3 |
| | Horse Creek | .322 | 3 |
| | Meyers Creek | .63 | 3 |
| | Locate Creek | .224 | 3 |
| | Archdale Creek | .434 | 3 |
| | Snow Creek | .448 | 3 |
| | Coal Creek | .896 | 3 |
| | Bolocate Creek | .224 | 3 |
| | Dislocate Creek | .224 | 3 |
| | Ten Mile Creek | 1.344 | 3 |
| | Little Powder River | .084 | 10 |
| | Hay Creek | .14 | 3 |
| | Allison Creek | .434 | 3 |
| | Dry Creek | .812 | 3 |
| | Horse Creek | .504 | 3 |
| | N. F. Bowers Creek | .112 | 3 |
| | Bell Creek | .014 | 3 |
| | Wright Creek | .056 | 3 |
| | S. F. Wright Creek | .336 | 3 |
| | Ranch Creek | .042 | 3 |
| | Williams Creek | .406 | 3 |
| | Prairie Creek | .532 | 3 |

# Yellowstone River Basin

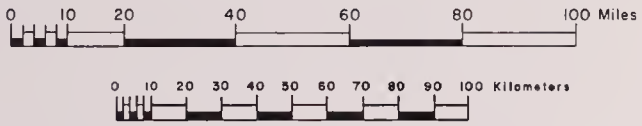
## Bureau of Land Management Application Non-Consumptive Use Only

1-Upper Deer Creek
2-Lower Deer Creek
3-Bridger Creek
4-Bear Creek
5-Cottonwood Creek
6-Jack Creek
7-Bluewater Creek
8-Fivemile Creek
9-Crooked Creek

Detailed map of requests in the Powder River drainage on page 27.

Minimum flow requests do not include the entire stream in all cases.

SOURCE: derived from applications received



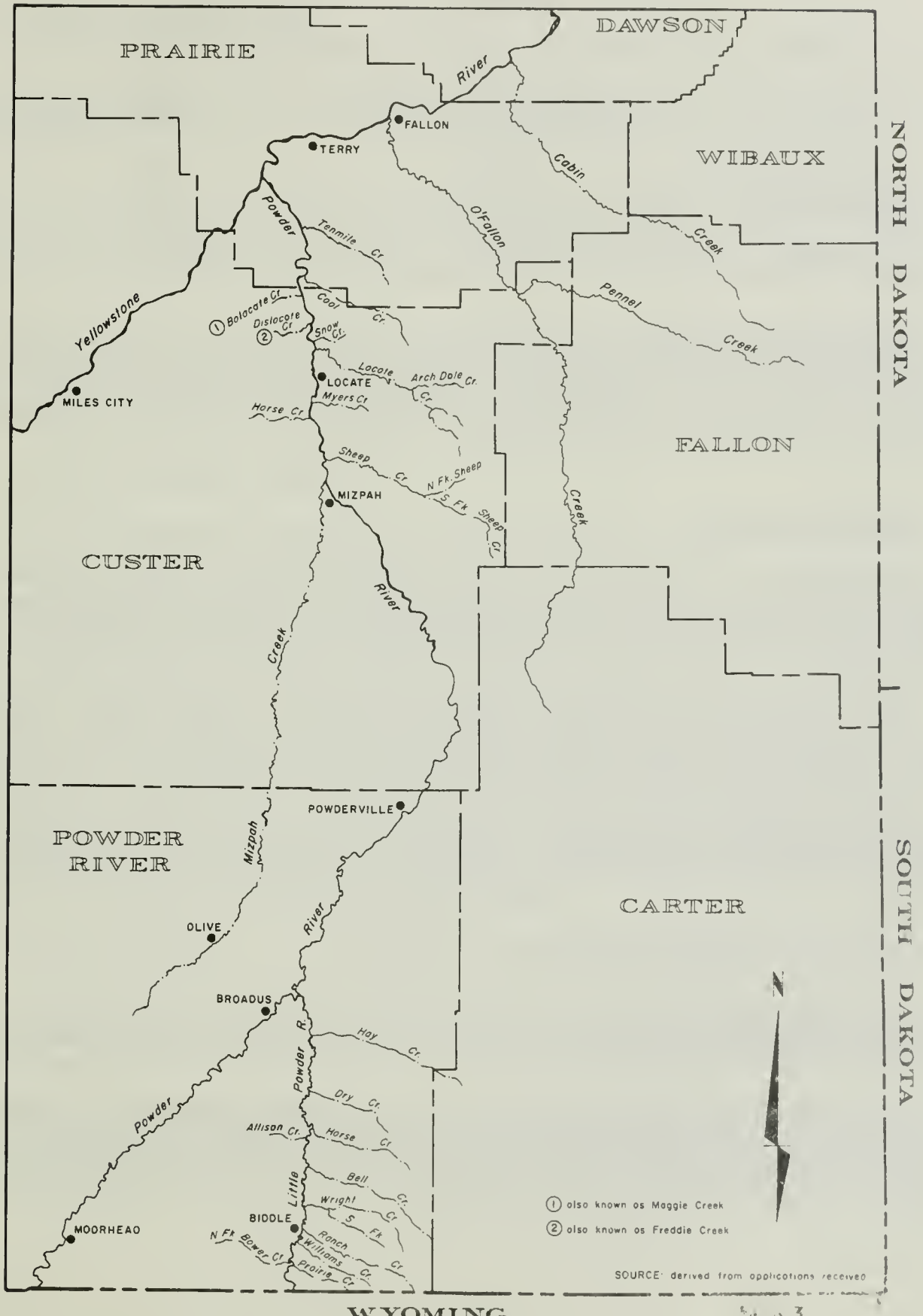


N

SIDNEY
RICHLAND
NORTH DAKOTA
McCONE
DAWSON
GLENDIVE
GARFIELD
PRAIRIE
WIBAUX
O'Fallon Creek
FALLON
MUSSELSHELL
TREASURE
Yellowstone River
MILES CITY
MEAGHER
WHEATLAND
GOLDEN VALLEY
ROSE BUD
CUSTER
SWEET GRASS
YELLOWSTONE
Shields River
COLSTRIP
BILLINGS
HARDIN
Bighorn River
Little Bighorn River
Rosebud Creek
GALLATIN
LIVINGSTON
PARK
STILLWATER
CROW
INDIAN
NORTHERN CHEYENNE INDIAN RES
ASHLAND
POWDER RIVER
CARTER
SOUTH DAKOTA
BROADUS
Boulder River
Stillwater River
Yellowstone River
Pryor Creek
Tongue River
Powder River
Little Powder River
CARBON
BIG HORN RESERVATION
Clarks Fork Yellowstone R.
Sage Ck.
Yellowtail Reservoir
Tongue River Reservoir
YELLOWSTONE NATIONAL PARK
WYOMING

Map 2

# Bureau of Land Management Instream Applications in the Powder Subbasin




Map 3

# Bureau of Land Management Instream Applications in the Powder Subbasin

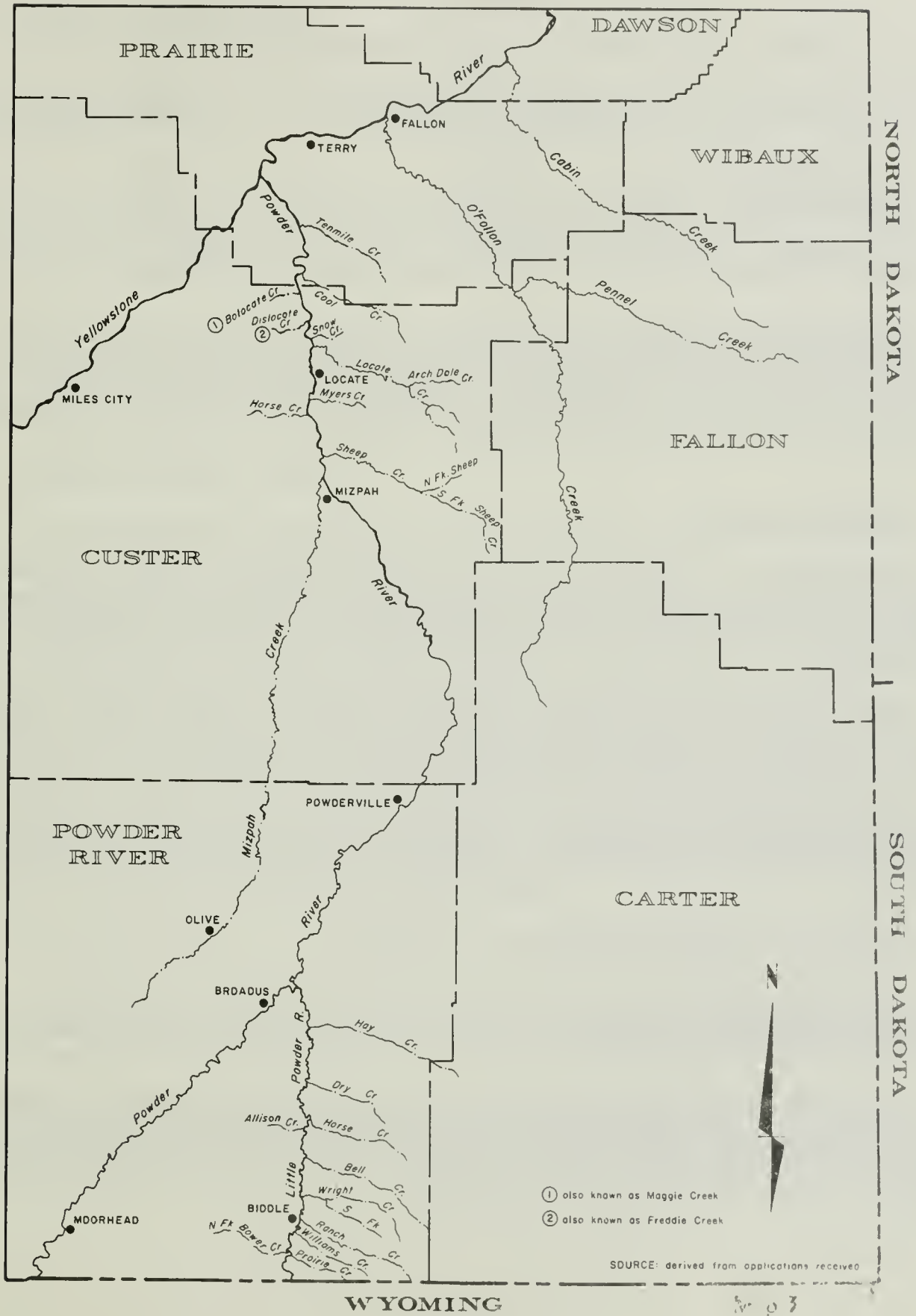


TABLE 12

BUREAU OF LAND MANAGEMENT RESERVATION REQUEST FOR IRRIGATION

| Source | Water Requested (af/y) | Irrigated Acres |
|---|---|---|
| Yellowstone River | 17,476 | 8,738 |
| Powder River | 1,098 | 549 |
| O'Fallon Creek | 2,924 | 1,992 |
| TOTAL | 21,498 | 11,279 |

Water Quality. Conversion of rangeland to irrigated, cultivated fields may tend to increase erosion and sedimentation, expecially if soils are not carefully managed. On the other hand, conversion of overgrazed rangeland or dry farmland to irrigated fields may decrease erosion and sedimentation due to improved vegetation cover. Irrigation return flows may be saline but would not significantly alter the quality of the streams involved.

SECONDARY IMPACTS

Socioeconomic. The granting of this reservation application would have the effect of securing a water supply for future irrigation on federal land. Implementation of the request would mean the conversion of 11,279 acres of rangeland or dry cropland to irrigated cropland, resulting in an increase in irrigation water use.

Under irrigation, the production capacity of the lands would increase. However, the reservation application did not estimate the irrigation costs for these lands. Therefore, a comparison of benefits and costs cannot be made.

Lands included in the application are widely distributed throughout the basin and are relatively small compared with existing irrigated lands; therefore, the economic benefits are expected to be relatively minor when compared to the existing situation.

Municipal and Domestic Water Use. Implementation of this request should not affect existing or potential municipal water systems.

Recreation and Aesthetics. The possible increased presence of waterfowl, which could result from expanded irrigation, could be considered a benefit to hunters and others.

Variations in vegetative cover and color would change the appearance of newly irrigated areas. The migratory waterfowl which may be attracted for feeding would also affect aesthetics, as would the presence of ditches, pipelines, sprinklers, powerlines, and pumping units. Minor disturbances such as noise and dust would temporarily result from irrigation development.

Historical-archeological. There are no known archeological or historical sites within the project areas.

## Environmental Impacts -- BLM Instream Use and Stock and Wildlife Watering Application

The purpose of the Bureau of Land Management instream application is to establish minimum flows to protect riparian vegetation on National Resource Lands and to ensure sufficient water instream for stock and wildlife watering. Protection of riparian vegetation is necessary to support wildlife using that vegetation for food and cover. Small amounts of water are also requested for stock consumption.

The generalized primary impacts described below are common for all streams. Because the application included instream requests for 40 different streams the description of secondary impacts following is organized by five of the nine planning subbasins described on page 123 of the Draft EIS.

### GENERALIZED PRIMARY IMPACTS

The small quantities requested for stock and wildlife water consumption will not adversely affect any stream for which that use is requested.

It is doubtful that the requested instream flows, in most cases, are sufficient to protect existing habitat or, in turn, the wildlife supported by that habitat. Riparian habitat maintenance is a function of water quality, channel form, groundwater table, and other processes directly related to streamflow. Particularly critical is the seasonal variation in streamflow that establishes the extent and type of riparian vegetation. High spring flows scour gravel bars, establish islands, and carry sediment; without those flows, stream regimen would be altered. The constant flows requested by the BLM would not be large and variable enough to satisfy those requirements. In some streams, notably the Powder and Tongue rivers, the request is relatively large; however, even in those rivers, high seasonal flows are important to existing riparian vegetation. Streamflows in most cases will probably never be depleted to the level requested by BLM, but, if they were, the requested flows would not serve the purpose intended.

### SECONDARY IMPACTS

Recreation and aesthetic values throughout the basin would be degraded if streams were depleted to the level requested. Other potential impacts are discussed by subbasin below.

Upper Yellowstone Subbasin. Granting this request would probably not materially hamper future consumptive-use appropriators in securing water. Table 13 compares the 80th percentile low flows in these streams to the Bureau of Land Management requests.

TABLE 13

BLM INSTREAM REQUESTS AND 80TH PERCENTILE LOW FLOWS FOR SELECTED STREAMS

| Stream | Flows (af) by Month | | | | | |
|---|---|---|---|---|---|---|
| | May | June | July | August | Sept. | Oct. |
| Boulder River | | | | | | |
| 80%tile | 48,955 | 132,270 | 51,122 | 7,257 | 7,500 | 8,730 |
| BLM | 1,540 | 1,490 | 1,540 | 1,540 | 1,490 | 1,540 |
| Bridger Creek | | | | | | |
| 80%tile | 6,150 | 15,420 | 15,375 | 1,540 | 1,430 | 1,910 |
| BLM | 310 | 300 | 310 | 310 | 300 | 310 |
| Stillwater River | | | | | | |
| 80%tile | 67,650 | 238,000 | 95,940 | 33,210 | 27,965 | 14,760 |
| BLM | 1,540 | 1,490 | 1,540 | 1,540 | 1,490 | 1,540 |
| Upper Deer Creek | | | | | | |
| 80%tile | 5,535 | 13,685 | 8,160 | 1,355 | 1,250 | 1,720 |
| BLM | 310 | 300 | 310 | 310 | 300 | 310 |
| Lower Deer Creek | | | | | | |
| 80%tile | 4,740 | 11,010 | 7,260 | 1,050 | 1,010 | 1,480 |
| BLM | 310 | 300 | 310 | 310 | 300 | 310 |

The water supply over and above the instream request is probably sufficient for future consumptive uses, including full service irrigation.

Clarks Fork Yellowstone Subbasin. The instream reservations for the Clarks Fork Yellowstone River and Bluewater, Cottonwood, and Fivemile creeks would not significantly affect water availability for new irrigation use: however, the request on Bear Creek (5 cfs), if granted, would probably not allow much new irrigation.

Bighorn Subbasin. The instream reservations for Sage and Crooked creeks (5 cfs) would not significantly affect water availability for new consumptive use.

Tongue Subbasin. Figure 2 illustrates water surplus associated with the BLM instream request for the Tongue Subbasin. The BLM request is for 130 cfs (94,120 af/y); the average annual flow is 304,000 af/y. Because of large monthly flow variations, there would be little water left over and above the instream request in August. In low-flow periods that occur only one year in ten (on the average), there would be nosurplus water during many months of the year, including the normal growing season (July, August, September, and October). Wyoming's share must be considered in reserving and allocating Tongue River water, as must federal and Indian water claims.

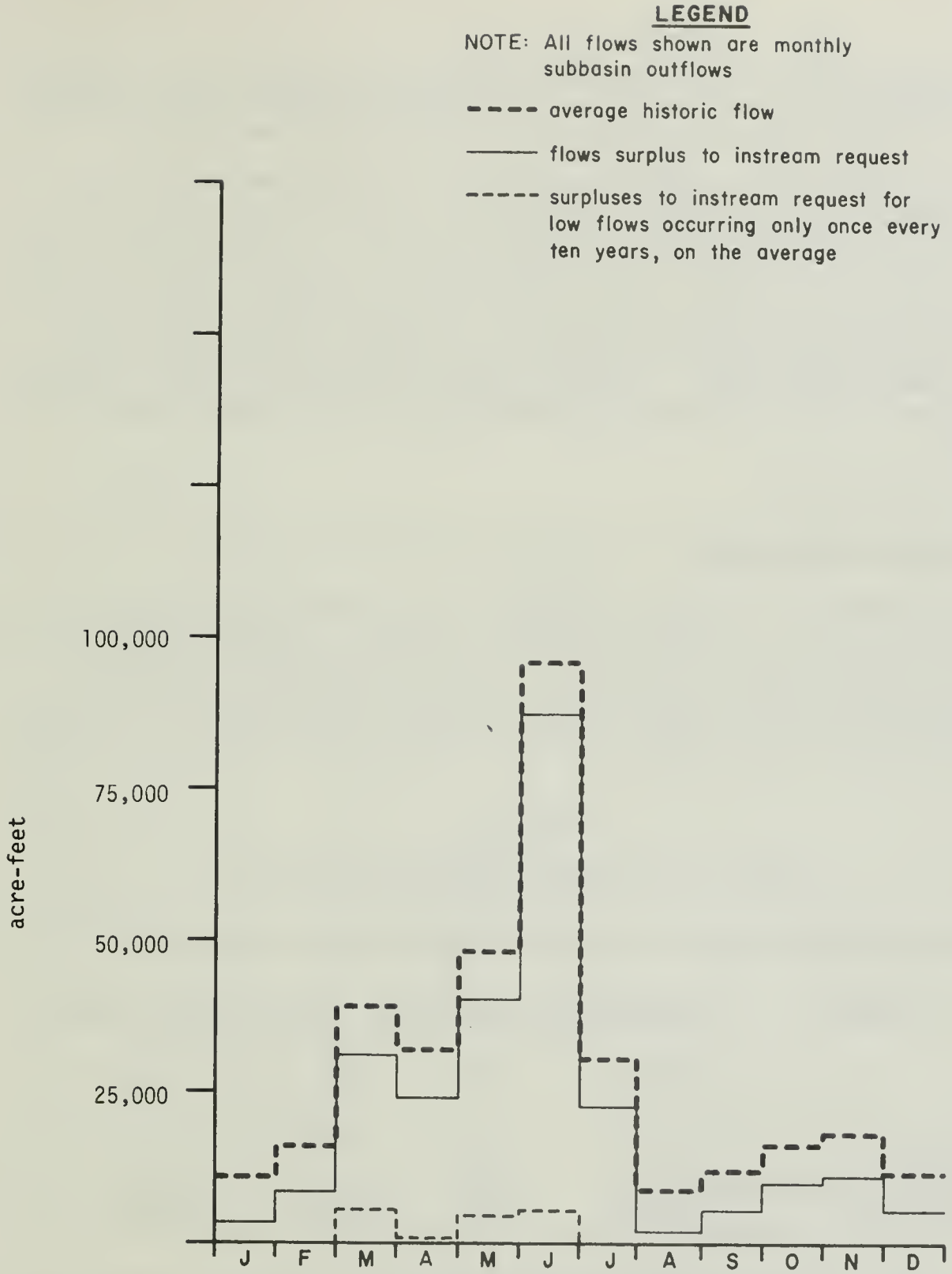



FIGURE 2. Tongue Subbasin Monthly Surpluses to the Bureau of Land Management Application

Powder Subbasin. For the Powder River, 200 cfs (144,800 af/y) is requested by the BLM; the average annual flow is 416,000 af/y. Figure 3 shows the effect of this requested reservation on the surplus waters of the Powder River.

While each of the streams identified in the application flows at the requested level during portions of the year, not all of the streams contribute those levels during all periods. In fact, during most of the year, the majority of these streams would not yield the flows requested. Even streams whose average annual flow is several times larger than the request, because of large seasonal flow fluctuations, would not satisfy this request year round. However, consumptive use of these streams (primarily for irrigation) occurs mostly either during spring runoff or after rain storms, when flows could be much higher than the requested minimum flows. Therefore, water availability for future irrigation may be only slightly hampered by the implementation of this water reservation request.

## BUREAU OF RECLAMATION

### Description of Application

The Bureau of Reclamation has applied for four separate reservations of water in the basin. In three of the four, water would be diverted from the Yellowstone mainstem during surplus-flow periods to offstream storage sites for use during low-flow periods for municipal, industrial, recreation, and fish and wildlife purposes. The three storage sites are Buffalo Creek, the Cedar Ridge site located on Starved-to-Death Creek, and Sunday Creek (see Map 1). Table 14 presents specific data on each.

TABLE 14

BUREAU OF RECLAMATION OFFSTREAM STORAGE SITES

| Location | Reservation Request | | Normal Storage | Minimum Storage |
|---|---|---|---|---|
| | af/y | cfs | (af) | (af) |
| Buffalo Creek | 68,700 | 370 | 72,700 | 1,860 |
| Cedar Ridge (Starved-to-Death Creek) | 121,800 | 450 | 126,800 | 5,000 |
| Sunday Creek | 539,000 | 2,100 | 553,000 | 14,000 |

In addition to the offstream storage projects, the Bureau of Reclamation has requested 131,700 af/y (864 cfs) of Bighorn River water (in addition to its existing storage of 1,375,000 af in Yellowtail Reservoir) to be used to provide full-service irrigation to 42,000 acres and a supplementary water supply to 950 acres. The water would be diverted from Yellowtail Reservoir to the Hardin Unit. The approximate location of the lands to be irrigated is shown on Map 1.

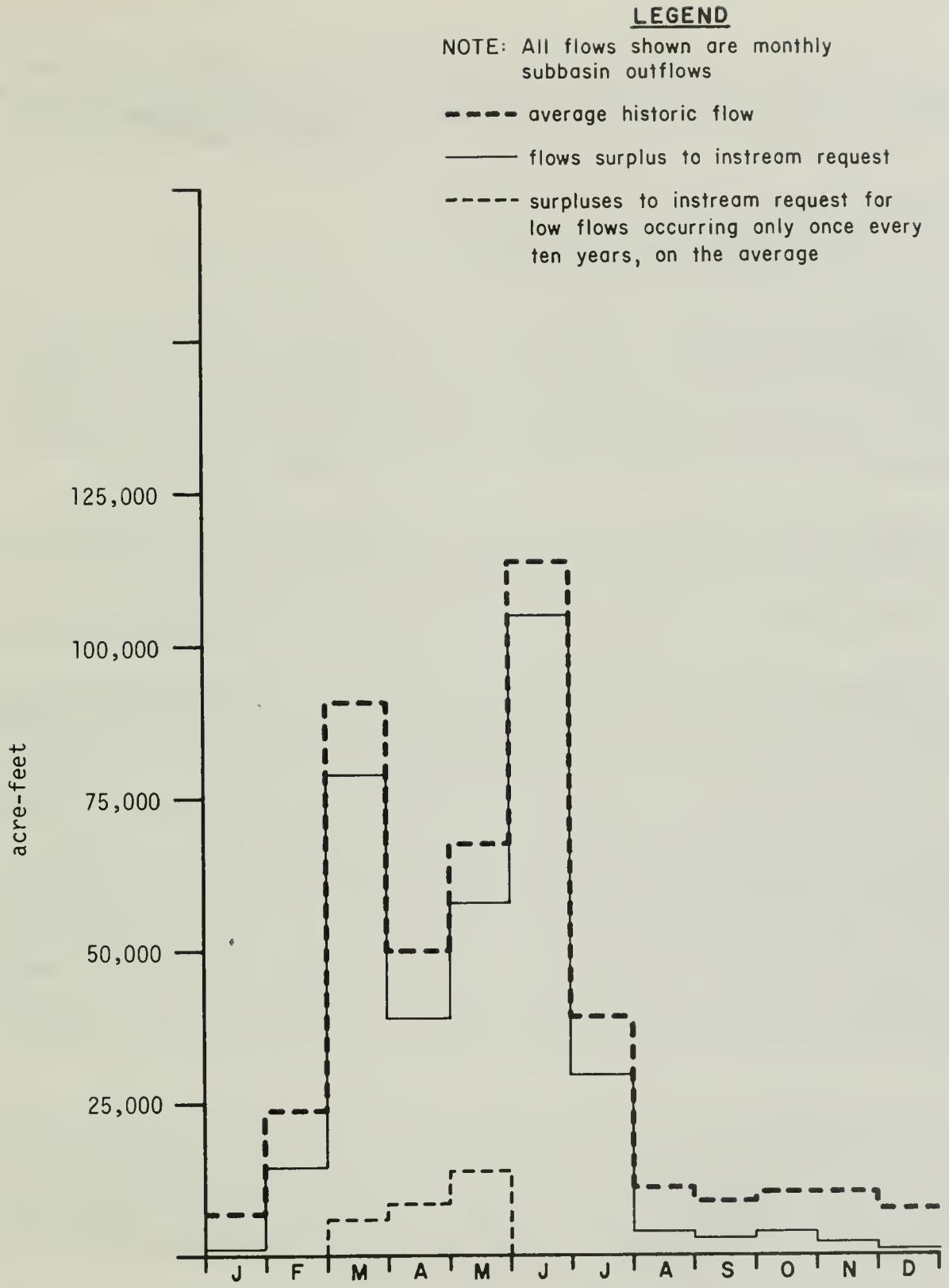



FIGURE 3. Powder Subbasin Monthly Surpluses to the Bureau of Land Management Application

The impacts to the natural and cultural environments described below would occur as storage is developed and the reserved water is put to use over a period of years. The same impacts might result following denial of each application, since the same projects might eventually be developed under water use permits.

## Environmental Impacts--Bureau of Reclamation Buffalo Creek Offstream Reservoir Proposal

### PRIMARY IMPACTS

Streamflow Alteration. The total diversion into the Buffalo Creek offstream site is expected to be about 68,700 af/y. This water would be diverted during the period from October 15 to March 15 by pumps with a total capacity of 370 cfs. However, according to the application, this pumping period could be extended until July 1, if necessary, to avoid adverse environmental effects. Impacts of this diversion on Yellowstone River flows would be negligible.

Channel Form. Impacts on Yellowstone River channel form as a result of this project would be negligible.

Water Quality. This project would probably have minor beneficial effects on salinity as water is released into the Yellowstone River in a low-flow period.

Ecosystems. No measurable impacts are expected on the aquatic system of the Yellowstone River as a result of the implementation of this application. Possible increased river-bottom scouring due to increased ice formation could disrupt habitat for aquatic wildlife and result in increased mortality.

Aquatic habitat loss at the reservoir site would be minimal, since Buffalo Creek is intermittent and contains no resident fish populations. Gains in aquatic habitat could be realized with construction of the reservoir, since a multispecies warm-water fishery could be established. Species such as walleye, northern pike, and largemouth bass should do well in the reservoir, since suitable spawning areas would probably be present and water levels would be rising or static during spawning periods. However, with frequent drawdowns (frequency of drawdown is not specified in the application, but previous Bureau of Reclamation operation studies show the frequency to be about one year in 25), the fishery in Buffalo Creek Reservoir could be severely limited (Montana Department of Fish and Game 1975).

The total area involved in the project would be about 5,530 acres including the take area (the area surrounding the reservoir purchased by the construction agency). The primary vegetation types in this project area are upland sagebrush, ponderosa pine, lowland sagebrush, and cropland. Vegetation in the project area would be either inundated or modified by increased human activity. Destruction or modification of these vegetation types would reduce or degrade habitat for mule and white-tailed deer, antelope, and upland game birds.

Increasing numbers of migratory waterfowl could be attracted to the new water surface area.

SECONDARY IMPACTS

Socioeconomic Analysis. The economic analysis shown in Table 15 was submitted by the Bureau of Reclamation as part of its water reservation application.

TABLE 15

ECONOMIC ANALYSIS--BUFFALO CREEK OFFSTREAM RESERVOIR SITE

| | | |
|---|---|---|
| ANNUAL BENEFITS | | $3,085,000 |
| Annual Construction Costs | $3,076,000 | |
| Annual OM & R | $ 9,000 | |
| TOTAL ANNUAL COSTS | | $3,085,000 |
| Annual Net Benefits | | 0 |
| Benefit Cost Ratio = 1:1[a] | | |
| Cost/acre-foot of conservation storage = $44.90 | | |

[a]Information submitted with the application assumed water would be sold at a rate that would exactly repay project costs.

Total employment resulting from construction of this project would be approximately 1,660 man-years over two years. To complete on-site construction, 427 people would be employed each year for two years. An additional 111 employees per year would be required for government off-site labor and overhead, and 292 employees per year in off-site supporting industries which produce the final products required in dam construction (USDI 1976a).

During the construction period there would be a large influx of people into the area. Total annual employment on the dam would be nearly 830 people. It is expected that 25 percent (210) of these employees would come from within the project area.

Because of the short construction period, many of the employees from outside the area would not move their families into the area but would instead live in temporary quarters, traveling to and from their homes on weekends. Of those families who did move to the area, most would live in Billings or Hardin and commute to work each day. Billings is more able to handle this type of growth and would experience little difficulty in providing public utilities and facilities for the construction population.

The communities which could feel a negative impact would be the small towns such as Custer and Bighorn in the immediate vicinity of the project. The influx of a construction-related population would place a strain on existing schools and public utilities in these small towns (USDI 1976a).

The estimates both of construction costs and of operation, maintenance, and repair (OM & R) costs include the costs of the energy inputs required to build and maintain these projects.

Municipal and Domestic Water Use. Implementation of this reservation request would not adversely affect existing or potential municipal water systems, and could provide water for that use.

Recreation and Aesthetics. The possible increased presence of waterfowl resulting from reservoir construction could be considered a benefit to hunters and sightseers. Flat-water recreation and fishing would increase as a result of the impoundment. The presence of pipelines, powerlines, and pumping plants would affect aesthetics. Minor disturbances such as noise and dust would temporarily result from dam and pipeline construction.

Historical-Archeological. There are no known archeological, historical, or cultural sites within the project area.

Environmental Impacts--Bureau of Reclamation
Cedar Ridge Offstream Reservoir

PRIMARY IMPACTS

Streamflow Alteration. Reservoir filling from the Yellowstone River would occur between October 15 and March 15, but could be extended to July 1, according to the application, if necessary to minimize adverse environmental effects. Pump capacity would be 450 cfs (26,780 acre-feet per month) with the pump running close to capacity for the entire normal filling period. The water supply in the Yellowstone is adequate to serve this project without causing significant streamflow alteration.

Water would be released to the Yellowstone River from Cedar Ridge Reservoir during a two-month period beginning on July 15, bringing the reservoir down to minimum pool and augmenting low flows. However, the application does not state where the water would be diverted for industrial use, so it is not known how long the reservoir releases would remain instream; in fact, water for industrial use could be diverted from the reservoir or directly below the evacuation point.

Channel Form. Water withdrawals during winter months would be only a small percentage of monthly flows but could cause additional ice formation in the river. Increased ice could cause additional river-bottom scouring.

Water Quality. Diversions to fill the reservoir would not alter water quality in the Yellowstone River. Releases during August could improve water quality while that water reamins instream. If industrial or municipal diversions are made upstream from the reservoir, then reservoir releases would be made to satisfy downstream rights. In this case, water quality benefits might accrue, since the releases may provide better quality water than instream water.

Ecosystems. The effects of this project on aquatic ecosystems would be the same as shown for the Buffalo Creek site above, except that, in this case, effects on the Yellowstone River would be proportionately greater because of the larger size of this project.

The land area affected by the reservoir would include 5,080 acres to be inundated and an additional 3,525 acres involved inside the take line. The primary vegetation type disrupted would be upland sagebrush, with lesser amounts of greasewood-sagebrush and juniper-ponderosa pine types being affected. A reduction in this vegetation would result in reduced food and cover for big game animals, primarily mule deer and antelope. The presence of a reservoir would open the possibility of muskrat being introduced in the area. Increasing numbers of migratory waterfowl may be attracted to the new reservoir.

SECONDARY IMPACTS

Socioeconomic. Costs and benefits estimated by the Bureau of Reclamation for Cedar Ridge are presented in Table 16.

TABLE 16

ECONOMIC ANALYSIS--CEDAR RIDGE OFFSTREAM RESERVOIR SITE

| | | |
|---|---|---|
| ANNUAL BENEFITS | | $2,108,100 |
| Annual Construction Costs | $2,092,000 | |
| Annual OM & R | $ 16,100 | |
| TOTAL ANNUAL COSTS | | $2,108,100 |
| Annual Net Benefits | | 0 |
| Benefit-Cost Ratio = 1:1[a] | | |
| Cost/acre-foot of conservation storage = $17.30 | | |

[a]Information submitted with the application assumed water would be sold at a rate that would exactly repay project costs.

The construction of the project, which would take three years, would bring in 100 construction people plus their families, making a total of 300 people. The number of school children expected to arrive with the construction crew is 35. Hysham is the major town in the area, with 363 inhabitants. However, many of these people would probably settle in Miles City, Forsyth, and Billings (USDI 1976a).

Municipal and Domestic Water Use. Implementation of this request should not adversely affect existing municipal water systems and could provide additional water for that use.

Recreation and Aesthetics. Effects of this project would be similar to those discussed above for the Buffalo Creek Offstream Reservoir.

Historical-Archeological. There are no known archeological, historical, or cultural sites within the project area.

## Environmental Impacts--Bureau of Reclamation Sunday Creek Offstream Reservoir Proposal

### PRIMARY IMPACTS

Streamflow Alteration. Water supply in the Yellowstone River is adequate to serve the needs of the proposed project. According to the application, the filling of the reservoir between October 1 and July 1 would be accomplished in the most environmentally acceptable manner. Although the pumping pattern is unspecified in the application, presumably this would mean diverting to pump capacities during high spring flows and at a steady (but lower) rate during the rest of the period. Table 17 shows a possible pumping pattern developed for the Sunday Creek site. The pattern assumes full pump volume (2,100 cfs) in the high flow months of May and June with one 700-cfs pump operating during the balance of the period. The effect of this possible operation scheme for withdrawals from the Yellowstone River is shown in figure 4.

TABLE 17

POSSIBLE PUMPING PATTERN FOR SUNDAY CREEK OFFSTREAM RESERVOIR SITE

| Month | cfs | af | Month | cfs | af |
|---|---|---|---|---|---|
| O | 550 | 33,615 | M | 700 | 43,040 |
| N | 700 | 41,650 | A | 700 | 41,650 |
| D | 700 | 43,040 | M | 2,100 | 124,125 |
| J | 700 | 43,040 | J | 2,100 | 124,960 |
| F | 700 | 38,880 | | | |
| | | | TOTAL | | 539,000 |

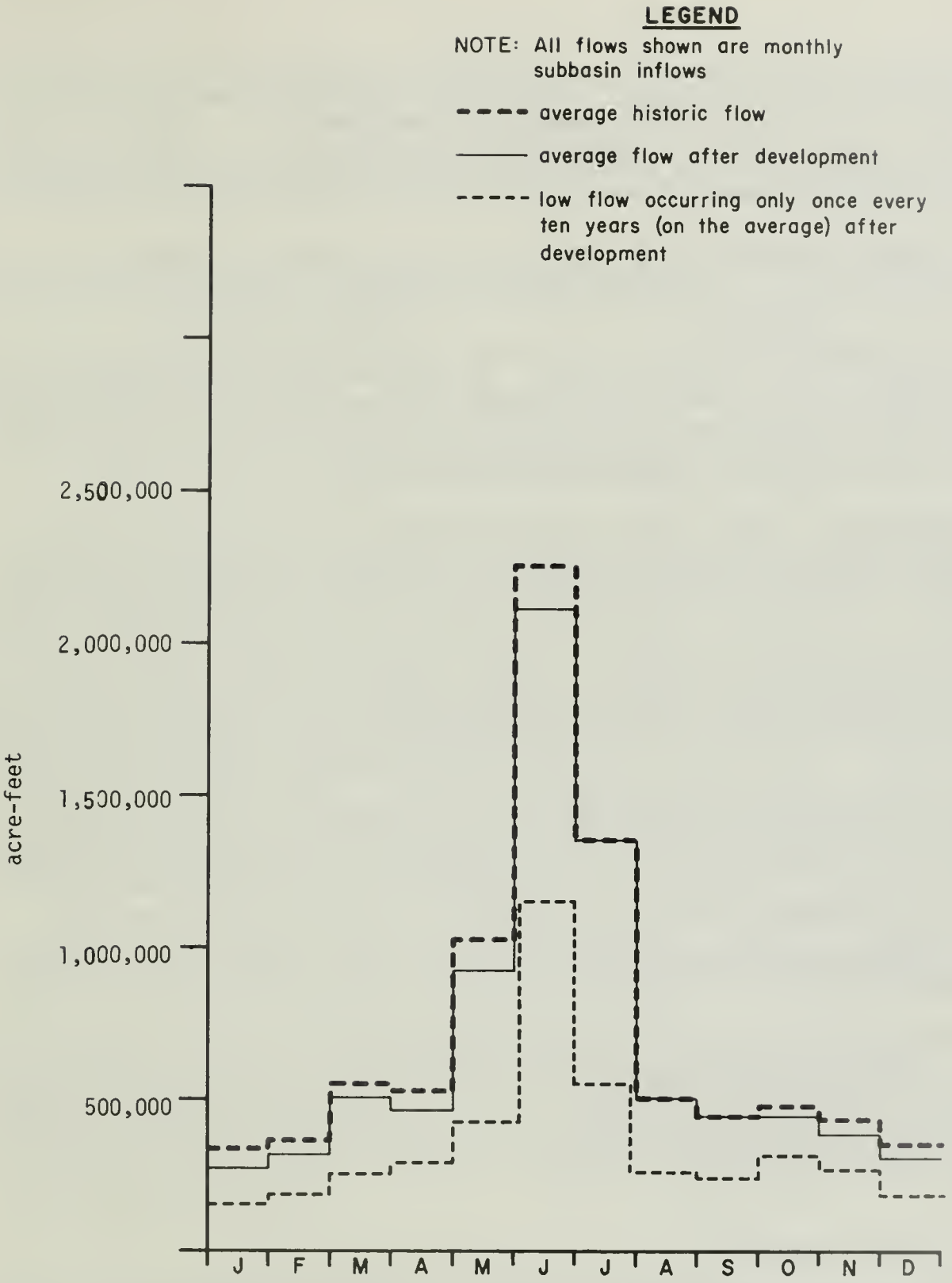



FIGURE 4. Kinsey Area Subbasin Monthly Inflows for the Bureau of Reclamation Sunday Creek Offstream Reservoir Application

Releases from the reservoir would occur in the latter half of July, August, and the first half of September. The points of diversion for use of this water are unknown. If the diversion for consumption is upstream, at the reservoir, or only a short distance downstream, then the effects of releases on Yellowstone River flows would be slight. The probable diversion area, assuming most of the water would be used for energy industrial purposes, is close to Miles City.

Channel Form. Water withdrawals during winter months could constitute as much as 20 percent of the natural flow of the Yellowstone River, causing additional ice formation and thus additional river-bottom scouring.

Water Quality. Diversions to fill the reservoir would not significantly alter water quality in the Yellowstone River. The reservoir would reduce sediments entering the river from the Sunday Creek drainage. Releases from the reservoir during summer low-flow periods would help dilute TDS concentrations in the Yellowstone for a short distance below the release point, assuming the diversion point would be close to the reservoir as suggested by the application.

Ecosystems. Winter is the period when aquatic populations are under the greatest stress and suffer their greatest natural mortality and biomass reduction. Riffles are commonly areas of greatest insect production in streams and are most affected by reduced flow levels in the winter, since the wetted bottom areas are reduced by a combination of lowered water levels and anchor ice formation. Although little is known about the effects of flow reductions in winter months, the withdrawals proposed for this project may have a detrimental effect on aquatic ecosystems in the Yellowstone River. Aquatic habitat losses at the site of the reservoir would be minimal because the stream involved is intermittent and contains no resident fish populations. A multispecies warm-water fishery could be established in the reservoir, if water levels do not fluctuate drastically. Species such as walleye, northern pike, and largemouth bass should do well in the reservoir, since suitable spawning areas would probably exist and water levels would be rising or static during spawning periods. Sunday Creek reservoir would have a significant minimum pool with sufficient depth remaining after drawdown to maintain a portion of the reproducing segment of the aquatic population (Montana Department of Fish and Game 1975).

Increasing numbers of migratory waterfowl may be attracted to the new water surface area.

About 13,700 acres would be inundated by the reservoir with another 11,950 acres in the take area being affected by increased human activity. Vegetation types at present are cropland (primarily alfalfa), cottonwood, lowland sagebrush, upland sagebrush, and ponderosa pine-juniper. The wildlife habitat provided by this vegetation would be destroyed or modified. Mule and white-tailed deer and antelope are the primary big game species in the area; the primary upland game bird is the sage grouse.

SECONDARY IMPACTS

Socioeconomic. The costs and benefits of the project, as estimated by the Bureau of Reclamation, are listed in Table 18.

TABLE 18

ECONOMIC ANALYSIS--SUNDAY CREEK
OFFSTREAM RESERVOIR SITE

| | | |
|---|---|---|
| ANNUAL BENEFITS | | $9,860,900 |
| Annual Construction Costs | $9,789,600 | |
| Annual OM & R | $ 61,300 | |
| TOTAL ANNUAL COSTS | | $9,860,900 |
| Annual Net Benefits | | 0 |
| Benefit-Cost Ratio = 1:1[a] | | |
| Annual Cost/acre-foot of conservation storage = $18.30 | | |

[a]Information submitted with the application assumed that water would be sold at a rate that would exactly repay the cost of the project.

The construction of the project is planned to take three years. Six hundred construction workers would be needed to complete the project. Counting workers and families, 1,700 total additional people would move into the area. The additional number of school children would be about 200.

Miles City is the largest city in the area, with 9,000 people. The influx of 1,700 people to the city and its surrounding area would put a strain on the social services of the city, including police protection, hospitalization, schools, water and utilities, transportation, and housing. Forsyth probably would receive some of the families (USDI 1976b).

Municipal and Domestic Water Use. Implementation of this water reservation request should not adversely affect existing or potential municipal water systems and may provide water for future needs.

Recreation and Aesthetics. The possible increased presence of waterfowl resulting from expanded irrigation could be considered a benefit to hunters and sightseers. The project would create a 13,700-acre reservoir along with recreational facilities including access roads, parking area, toilets, fire grates, and boat ramps, providing water-oriented recreational benefits.

The presence of pipelines, powerlines, and pumping units would affect aesthetics. Minor disturbances such as noise and dust would temporarily result from dam and pipeline construction.

Historical-Archeologic. There are no known archeological or historical sites within the project area.

## Environmental Impacts--Bureau of Reclamation Hardin Unit Development Proposal

### PRIMARY IMPACTS

Streamflow Alteration. The lands proposed to be irrigated in the Hardin Unit would be served by natural flows of the Bighorn River as long as they are sufficient;

when they are not, impounded water from Yellowtail Reservoir would be used. Of the 131,700 af/y of water diverted for use on the Hardin Unit, 52 percent, about 68,500 af/y, would be depleted.

The water supply in the Bighorn River, supplemented by Yellowtail Reservoir, would be adequate to serve the Hardin Unit without causing significant streamflow alterations.

Channel Form. Regulation of the Bighorn River by Yellowtail Reservoir has altered the form of the river channel below the dam. The relatively small depletion caused by the proposed Hardin Unit would not materially increase that alteration.

Water Quality. Existing water quality in the Bighorn River is good, and irrigation of 42,000 acres in the Hardin Unit would slightly degrade that quality. The increase in total dissolved solids (TDS) would probably average less than 10 percent (USDI 1971).

Conversion of rangeland to irrigated, cultivated fields may tend to increase erosion and sedimentation, especially if soils are not carefully managed. On the other hand, conversion of overgrazed rangeland or dry farming to irrigated fields may decrease erosion and sedimentation due to improved vegetative cover.

Ecosystems. No impacts are expected on the aquatic ecosystem of the Bighorn River as a result of the implementation of this application.

Increasing numbers of migratory waterfowl may be attracted to the newly irrigated fields for feed.

Wildlife habitat would be decreased because of increased human habitation, fencing, livestock, and farming operations.

The largest ecosystem change would be the conversion of 42,000 acres of primarily dry farmland and rangeland to irrigated cropland.

SECONDARY IMPACTS

Socioeconomic. Table 19 illustrates the costs and benefits of the proposed Hardin Unit as given in the Bureau of Reclamation application.

TABLE 19

ECONOMIC ANALYSIS--HARDIN UNIT

| | |
|---|---|
| Annual Benefits | |
| Irrigation | $6,221,400 |
| Wildlife | $ 10,400 |
| TOTAL ANNUAL BENEFITS | $6,231,800 |
| | |
| Annual Construction Cost | $4,262,800 |
| Annual OM & R | $ 216,800 |
| TOTAL PROJECT COSTS | $4,479,600 |
| Benefit Cost Ratio = 1.39:1 | |

Irrigation of 42,000 new acres would create 105 on-farm jobs and 147 off-farm jobs. The increased employment and spending would stimulate business activity in the Hardin vicinity.

Municipal and Domestic Water Use. Implementation of this request would not affect existing or potential municipal water systems.

Recreation and Aesthetics. The possible increased presence of waterfowl and upland game birds resulting from increased irrigation could be considered a benefit to hunters and sightseers. Decreases in big game habitat could reduce the opportunity for big game hunting.

Variations in vegetative cover and color would change the appearance of newly irrigated areas. The migratory waterfowl which may be attracted for feeding would also affect aesthetics, as would the presence of ditches, pipelines, sprinklers, powerlines, and pumping units. Minor disturbances such as noise and dust could temporarily result from irrigation development.

Historical-Archeological. Fort Smith, an early infantry post established in 1866, and the Bozeman Trail, a historical route of travel between Fort Laramie, Wyoming, and Virginia City, Montana, are important historical sites adjacent to the project, but these would not be affected by development of the unit (USDI 1971).

## LITTLE BEAVER CONSERVATION DISTRICT

### Description of Application

The Little Beaver Conservation District applied for a total of 25,546 af/y from O'Fallon, Pennel, and Cabin creeks. See Map 1 for the location of these streams. The water is to be used for irrigation, water spreading, stock water, recreation, and wildlife.

The request includes 8,546 af/y for irrigation of 5,300 acres. The request also stipulates 12,000 af/y for water spreading on 8,000 acres. In addition, 3,600 af/y is requested for stock ponds and 1,400 af/y for recreational purposes.

### Environmental Impacts--Little Beaver Conservation District Application

PRIMARY IMPACTS

Streamflow Alteration. The hydrograph (figure 5) for O'Fallon Creek shows that a major impact on streamflow would result from the proposed irrigation withdrawals; for example, for July, August, and September, the irrigation requirement would exceed the average streamflow.

The request for 12,000 af/y for water spreading can be met by the streamflow peak. In figure 5 this requirement is apportioned between the major and minor hydrograph peaks occurring in March-April and June. Forty percent of the water spreading requirement is assumed to be met in both March and April and twenty percent

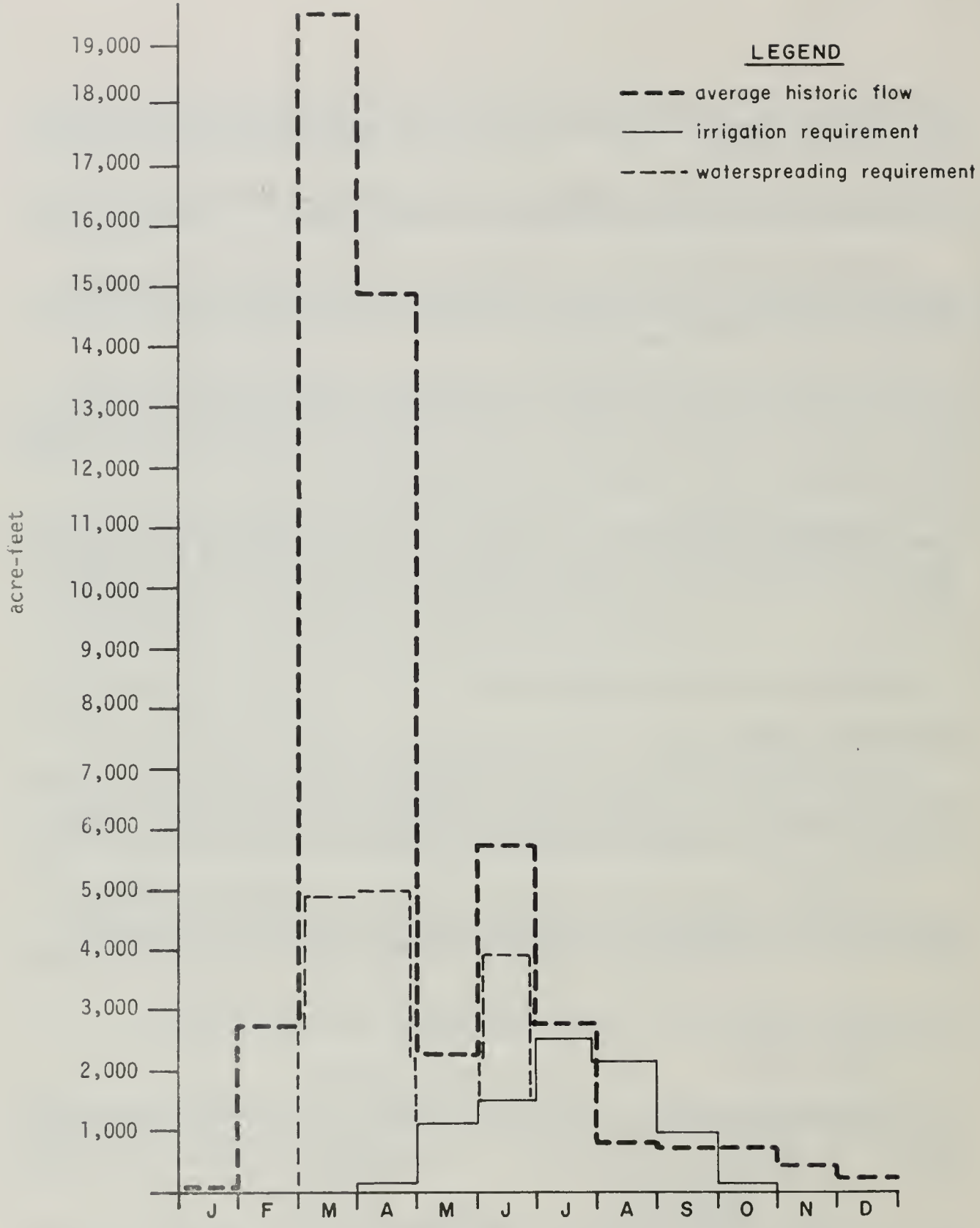



FIGURE 5. O'Fallon Creek Monthly Outflows for the Little Beaver Conservation District Application

is taken from the June peak. The most significant reduction in streamflow caused by water spreading and irrigation would occur in June.

Stock pond and recreational development is not expected to have any major effects on streamflow, although substantial developments in the watershed may cause a minor delay in the flood peak and distribute peak flows over a longer time period.

Similar effects would occur in Pennel and Cabin creeks.

Channel Form. Peak flows in O'Fallon, Pennel, and Cabin creeks are largely responsible for the existing channel form. Although these peak flows may be partly reduced by water spreading irrigation, no changes in channel form are anticipated.

Water Quality. Water quality data are not available for streams affected by the Little Beaver Conservation District application.

Conversion from rangeland or dry cropland to irrigated cropland may tend to increase erosion and sedimentation, especially if soils are not carefully managed. On the other hand, conversion of overgrazed rangeland or dry farmland to irrigated fields may decrease erosion and sedimentation due to improved vegetative cover. Reduction of streamflows by irrigation will leave less water for dilution of dissolved solids, whether the dissolved load is introduced naturally or by irrigation return flows.

Ecosystems. Several sepcies of game fish (e.g. sauger, channel catfish, and burbot) are found in O'Fallon Creek, along with minnows, suckers, and other nongame fish. The plains killifish maintains a thriving population in O'Fallon Creek, even though its distribution is limited in Montana and the Northern Plains.

It is thought that peak flows trigger a spawning response, causing many of these species to enter O'Fallon Creek in the early spring. Because irrigation requirements of the reservation requests would dewater or nearly dewater the stream roughly five years out of ten in late summer months, young fish produced by spring spawning and resident fish would be killed by dewatering on an average of every other year. An increase in the frequency of summer dewatering would adversely affect the fishery habitat, the spawning success of game and nongame fish, and the resident fish populations, incldiuing the relatively rare plains killifish.

SECONDARY IMPACTS

Socioeconomic. Reserved water is requested for stockwater ponds, water spreading, sprinkler irrigation, and recreational ponds. The data submitted with the application are only sufficient to do economic analysis on the irrigation proposal. The benefits from water spreading were estimated to be $50/acre/year. The annual cost of the $225 per acre initial cost is $20 when computed for 20 years using a 6 3/8 percent rate.

Sprinkler irrigation would raise yields from one to five tons of hay per acre with an increase in income of $100/acre. Projected total annual costs of a side-roll sprinkler system are estimated to be about $25/acre/year (DNRC 1977).

It is estimated that each 400 acres of full-service irrigation creates one new job; completion of the full-service irrigation proposed would add about 13 new jobs to the region.

Municipal and Domestic Water Use. There would be no impact on municipal or domestic water use caused by approval of the Little Beaver Conservation District's request.

Recreation and Aesthetics. Increased irrigation and stockpond development could result in increased waterfowl and fisheries habitat, a beneficial impact if stockponds and recreational ponds are sufficiently deep and large to maintain the essential habitat for waterfowl and fish the entire year. Recreational advantages are contingent upon landowner/recreationist relationships.

Historical-Archeological. No known sites would be affected by the developments anticipated in the Little Beaver Conservation District application.

## CUMULATIVE APPLICATIONS AND ASSOCIATED IMPACTS

From the discussions of water availability presented in the Draft EIS, Volume I, Part III, it is apparent that not all water reservation applications can be approved. There is not enough water to fully satisfy all applicants in some subbasins. The conflict among some reservation applicants is further aggravated by the unquantified existing rights (including Indian and federal reserved water) and by Wyoming's share of the four interstate tributaries. The conflict is primarily between instream and consumptive uses. Although there are a few exceptions, approval of each consumptive use request would not adversely affect any other diversionary application. Likewise, all instream use applications could be approved since those applications are not in conflict with one another.

### CUMULATIVE CONSUMPTIVE USE APPLICATIONS

It is possible to approve the consumptive use applications without significant adverse impacts on water supply for other consumptive requests. Depletions as a result of implementation of all consumptive use reservation requests would total about 1.65 million af/y (table 20). However, even if the Board were to approve all consumptive use applications, it is doubtful that much development would occur beyond that point projected as the high level of irrigation, industrial, and municipal development for the year 2000 given in the Draft EIS. These levels are much less than development proposed in the reservation requests. In the discussion following, the cumulative effects of granting all consumptive use reservation requests will be addressed.

#### Basinwide Impacts

##### PRIMARY IMPACTS

Streamflow Alterations. Although there are some significant exceptions, the Yellowstone mainstem and its tributaries have an adequate water supply to provide the depletion amounts identified; however, some projects would necessitate storage on tributaries. As depletions accumulate downstream, significiant adverse environmental effects would result.

Channel Form. The channel formation processes are expected to be affected little or not at all by the projected depletions in the mainstem and most tributaries. The form of the Tongue River channel has already undergone change from a braided to a predominantly single channel following construction of Tongue River Dam; further impoundment and depletion on that river should have little effect. There would be a great deal of change in the form of the Powder River channel, however, if that now-unimpounded stream were dammed (see page 278 of the Draft EIS).

TABLE 20

CUMULATIVE CONSUMPTIVE USE APPLICATIONS (af/y)

| Subbasin | Irrigation | | Municipal | | Industrial | Total |
|---|---|---|---|---|---|---|
| | Acres | Dep. | Div. | Dep. | (Dep.) | (Dep.) |
| Upper Yellowstone | 65,241 | 126,530 | 22,150 | 11,075 | 0 | 137,605 |
| Clarks Fork Yellowstone | 21,282 | 38,856 | 0 | 0 | 0 | 38,856 |
| Billings Area | 29,330 | 58,140 | 334,290 | 100,285 | 68,700 | 227,125 |
| Bighorn | 51,675 | 86,530 | 0 | 0 | 0 | 86,530 |
| Mid-Yellowstone | 47,329 | 99,400 | 0 | 0 | 121,800 | 221,200 |
| Tongue | 13,000 | 29,250 | 0 | 0 | 28,750 | 58,000 |
| Kinsey | 18,783 | 35,542 | 21,720 | 10,860 | 539,000 | 585,402 |
| Powder | 60,756 | 116,757 | 605 | 303 | 0 | 117,060 |
| Lower Yellowstone | 92,446 | 170,124 | 12,756 | 6,378 | 0 | 176,502 |
| GRAND TOTAL | 399,842 | 761,129 | 391,521 | 128,901 | 758,250 | 1,648,280 |

Note: Dep. = Depletion, Div. = Diversion

Water Quality. The potential for water quality degradation exists in the middle and lower basin, becoming greater as the river progresses downstream.

For the cumulative applications, salinity would not be a problem in the upstream subbasin (including the Clarks Fork Yellowstone and Bighorn), even though irrigation return flows would be high in salts, because the streamflows would be adequate to dilute the saline return flows. In subbasins farther down the mainstem, the build-up of salts would result in occasional salinity problems in low-flow months.

In the Tongue and Powder subbasins, flows would be substantially reduced, resulting in significant water temperature increases during the late summer and fall.

The conversion of rangeland to cultivated, irrigated fields may tend to increase erosion and sedimentation, especially if soils are not carefully managed. However, where overgrazed rangeland or dry cropland are converted to irrigated fields, erosion and sedimentation could be reduced due to improved vegetation cover.

The Yellowstone mainstem has adequate capacity to transport modest increases in sediment load. The Bighorn and Tongue rivers would not become major sources of sediment to the mainstem because of the effect of reservoirs on those rivers. The sediment contribution of the Powder, now the main source of sediment to the mainstem, would actually be decreased if dam construction is accomplished to provide additional water supply for conservation districts. It may be concluded that little impact would result from sedimentation as a result of granting all reservation requests for consumptive use.

Ecosystems. Any newly cultivated lands in the basin could serve as feeding areas for migratory waterfowl; increasing numbers of both geese and ducks would probably stop to feed along the rivers during Central Flyway migration.

Stabilizing streamflow through new storage or increasing streamflow fluctuations through such actions as diversion during low-flow periods would affect the dominant green alga Cladophora, as discussed on pages 242-43 of the Draft EIS.

Inundation by proposed reservoirs would destroy terrestrial wildlife habitat, but would generally create additional aquatic habitat.

SECONDARY IMPACTS

Agriculture Water Use. Assuming implementation of all consumptive use applications, TDS concentrations in three mainstem subbasins (Mid-Yellowstone, Kinsey Area, and Lower Yellowstone) would be high enough during low-flow months during some years to require careful application of water to avoid salt accumulation in the root zone. In the Powder Subbasin, TDS concentrations would be high enough to make using that water for irrigation unwise. Provisions for instream flows would tend to mitigate the salinity problem.

Reduced streamflows could lower water levels to the point that existing diversion structures, particularly the smaller gravity diversions, would not function. Large diversions usually have small dams to maintain heads, and pump intakes are usually low enough to operate even when flows are low.

According to information in the conservation district applications, if all anticipated irrigation (about 290,000 acres) were developed, the annual payment capacity would exceed annual irrigation costs by about $18,775,000. If all irrigation projected in the applications were actually developed, that amount would be the net annual income increase to farmers, before taxes. Had that expanded irrigation been developed in 1972, it would have accounted for about 2.6 percent of the basin's total personal income of $721,522,000.

This estimated increase in total personal income is probably overstated because the cost estimates did not include land acquisition costs, legal fees, and conservation district overhead. In addition, the relative importance of agriculture is declining in the basin due to the increase in the manufacturing, energy, and service industries.

On-farm employment benefits from irrigation expansion would probably be insignificant. Agriculture is noted for technological innovations which increase productivity and reduce labor requirements; this trend is evident in the Yellowstone Basin. During the 1950's, while the output of agricultural products was increasing, a lack of employment opportunities led to an outmigration of working-age people. While the new irrigation may create enough jobs to counter-balance the employment decline due to technical progress, it will not add enough additional workers to reverse the prevailing trend.

The major employment benefits would be in the services and industrial sectors which supply farm inputs and in consumer goods for the increased regional centers that sell goods and services to farmers.

From 1960 to 1970, all towns in the basin except Billings experienced declines in population. Increases in employment outside the Billings regional trading center may help to stem these declines in the other trading centers such as Miles City, Glendive, and Sidney. This would be an important social benefit because migration from these towns to Billings requires additional investment in schools, roads, and other public services, while these facilities remain underutilized in the declining towns.

The comparatively small use of water for agricultural purposes other than irrigation would not be affected.

See page 320 of the Draft EIS for a summary description of the effects of energy-industrial development on socioeconomic concerns.

Municipal and Domestic Water Use. Assuming implementation of all consumptive use applications, water would generally be available for municipal needs. In some cases, decreased water quality may require additional water treatment prior to domestic use.

Industrial Water Use. Implementation of the Bureau of Reclamation water reservations would tend to make surface water available to industry and help ensure that more expensive alternatives, such as development of deep groundwater, would not have to be chosen.

See the discussion under DNRC and Bureau of Reclamation applications (pages 18 and 32 ) for the economic effects of industrial applications.

Recreation and Aesthetics. Recreational and aesthetic experiences along basin rivers are related to streamflows. In subbasins where streamflows would not significantly change (for example, the Bighorn), recreation and aesthetics would not be much affected. In others, such as the Tongue and Powder subbasins, both recreation and aesthetics would be adversely affected, although these impacts on recreation might be partially mitigated by creation of flat-water recreation opportunities.

## Subbasin Impacts

### UPPER YELLOWSTONE SUBBASIN

The Yellowstone mainstem in this subbasin has an adequate water supply for the reservation applications without storage, and without causing serious environmental impacts. See Part III (page 153) of the Draft EIS for the impacts of irrigation in the tributaries and a more detailed discussion of impacts on the Yellowstone River.

### CLARKS FORK YELLOWSTONE SUBBASIN

Cumulative effects of consumptive use reservation requests are essentially those involved with the Carbon Conservation District application. See page 153 through 158 in the Draft EIS for a discussion of those impacts.

### BILLINGS AREA SUBBASIN

If all applications in this and the two upstream (Upper Yellowstone and Clarks Fork Yellowstone) subbasins were implemented, the associated reduced flows would begin to noticeably accumulate in this subbasin. Combined applications would deplete about 400,000 af/y in and above this subbasin.

Water availability would not generally be a problem in the Billings Area Subbasin. It would not be necessary to provide additional water storage by impounding the now-free-flowing Yellowstone River. However, one year in ten, there would be very low flows in August and September.

The Yellowstone mainstem in the Billings Area Subbasin, is in the transition zone between the salmonid cold-water fishery of the headwaters and the nonsalmonid warm-water fishery of the plains. The streamflow reductions which would result from project implementation, especially at the 90th-percentile August and September low-flow levels, would stress this marginal habitat for trout and whitefish to the point that the fisheries transition zone would shift upstream. A popular recreational fishery near a large urban center could be lost.

### BIGHORN SUBBASIN

The Bighorn River is heavily regulated by Buffalo Bill, Boysen, and Yellowtail dams which have already effected major environmental changes in the

river. Implementation of the reservation applications would cause few further changes. With Yellowtail Dam, the water supply is more than adequate to allow the 86,000 af/y depletion.

MID-YELLOWSTONE SUBBASIN

Implementation of consumptive use applications in this subbasin would result in the depletion of about 220,000 af/y; in addition, the cumulative effects of depletions in the Upper Yellowstone, Clarks Fork Yellowstone, Billings Area, and Bighorn River subbasins (about 710,000 af/y) would be felt here.

Primary Impacts. For the four areas of primary impact listed below, the cumulative effects of upstream depletions would be more noticeable than those in the Billings Area Subbasin, upstream, but less than for the Lower Yellowstone Subbasin.

1) Streamflow Alterations. Although the Yellowstone mainstem is unimpounded, the Mid-Yellowstone Subbasin reflects the influence of the Bighorn River, which is heavily controlled. Although no new mainstem storage is involved in reservation requests, water availability would not generally be a problem. Exceptions might occur in August and September, when flows would be seriously low about one year in ten.

2) Channel Form. Reduced flows would decrease the sediment transport capacity of the river. However, the present sediment transport capacity is considerably in excess of the sediment load, but at the levels of depletion projected, localized sedimentation problems may be expected in backwaters and behind diversion structures.

3) Water Quality. At this time, average TDS concentrations in the Mid-Yellowstone mainstem are moderate, except that in December and January values exceed 500 mg/l. About one year in ten, January TDS concentrations would exceed 700 mg/l. For 90th-percentile low flows, the annual TDS concentrations would increase only slightly. However, during August, the TDS concentration could approach 1,000 mg/l, a 60 percent increase over the historical value. Lesser but substantial increases would be experienced in July and September.

4) Ecosystems. If the reservation requests were implemented, streamflows during August and September would be reduced and TDS concentrations increased to the point that the aquatic ecosystem would be placed under stress. It is unlikely that a long-term or irreversible degradation would occur, unless several low-flow years happened in succession.

Secondary Impacts. Water would generally be available to consumptive users in the subbasin. The presence of pipelines, powerlines, and pumping units would affect aesthetics and recreation, as would increased population.

Minor disturbances such as noise and dust would temporarily result from dam and pipeline construction.

TONGUE SUBBASIN

Since nearly all consumptive use applications in the Tongue Subbasin are duplicated by the DNRC application, the cumulative impacts would be those presented on pages 15 through 21.

KINSEY AREA SUBBASIN

The cumulative effects of depletions above this subbasin would be felt in the Kinsey Area Subbasin in addition to the impacts of reservation requests within the subbasin, the largest of which is the Bureau of Reclamation Sunday Creek Offstream Reservoir request. Because the existing conditions and expected flow changes are nearly the same in this subbasin as in the Lower Yellowstone Subbasin, the impacts in the two subbasins would be nearly identical. Refer below to the discussion of impacts on the Lower Yellowstone Subbasin.

POWDER SUBBASIN

Because consumptive use applications in the Powder Subbasin are almost identical to the intermediate level of irrigation development discussed under the Irrigation Emphasis Alternative, see pages 253-288 of the Draft EIS for evaluation of the associated impacts.

LOWER YELLOWSTONE SUBBASIN

Because this subbasin is farthest downstream on the mainsteam, the cumulative impacts of all mainstem and tributary development would be felt here. Depletions as a result of implementation of all water reservation requests would include about 760,000 af/y for irrigation and 760,000 af/y for industrial use.

Primary Impacts. The four areas of primary impact in this subbasin are streamflow alteration, channel form, water quality, and ecosystems.

1) Streamflow Alteration. Water supply in the Yellowstone River is generally adequate, even without storage and considering upstream depletions, to meet requests for this subbasin. An exception could occur in August and possibly September, when streamflows would be severely depleted about one year in ten.

2) Channel Form. Due to decreased flows, sediment transport capacity could decrease more than 30 percent. Whether this decrease would cause sedimentation and aggradation depends on the supply of sediment

to the river. That supply has already been decreased by the construction of dams on the Bighorn and Tongue rivers. Moorhead Dam on the Powder River would decrease it even further. Therefore, the reduced sediment transport capacity would probably be adequate for the sediment supply, and aggradation would not occur.

3) Water Quality. Impacts on water quality of the cumulative requests would be significant. TDS concentrations in August could increase 100 percent, making it imperative for irrigators to exercise good water management in water application.

4) Ecosystems. The cumulative withdrawals of all consumptive applications would have a marked effect on streamflows, especially during August and September, the most important months for growth of adult fish and rearing of young fish. Reduced flows would result in a substantial reduction in food production in riffle areas. Coupled with increased temperatures and reduced diurnal dissolved oxygen concentrations, the reduced food production would severely affect most fish, especially species such as shovelnose sturgeon and goldeye which are heavily dependent on insects for food. Channel catfish could probably utilize small forage fish, rather than insects, as a food supply.

The reduced fish habitat and degraded water quality which would occur as August flows approached 1,000 cfs would affect game fish like sauger and shovelnose sturgeon more than such nongame fish as carp. The tendency would be for fish population compositions to shift toward greater proportions of nongame species.

These adverse effects may be irreversible if low-flow years succeed one another, not an unexpected occurrence.

The increase in irrigated agriculture would tend to attract more migrant waterfowl for feeding. Spring flows would not be reduced enough to adversely affect goose nesting.

The impact on beaver and other riparian furbearers would be minimal.

Secondary Impacts. Water would generally be available and suitable for agricultural and industrial users. Occasional high TDS concentrations would require careful irrigation water management.

Water would be unsuitable for domestic use, since TDS values would exceed 500 mg/l in all months but May, June, and July.

The existing seminatural, semipastoral Yellowstone Valley could become more industrialized and urbanized. Land use patterns, which historically have reflected agriculture and wildlife habitat, would be partially converted to irrigated cropland, with a resulting loss of habitat for some wildlife species. The increase in irrigated acreage would increase the numbers of migratory waterfowl attracted to the area.

Recreation opportunities that emphasize natural surroundings would diminish due to fish and wildlife habitat destruction, alteration of aesthetics, and increased human population.

## CUMULATIVE INSTREAM APPLICATIONS

Granting one instream flow application would not adversely affect another instream reservation. Therefore, all instream requests, including the BLM request, could be approved. This situation would be the same as the Instream Flow Emphasis Alternative of Part IV of the Draft EIS, beginning on page 290.

## MUTUAL EXCLUSIVENESS OF RESERVATION APPLICATIONS

Despite an apparently abundant water supply, the Yellowstone Basin does not produce enough water to satisfy the demands of all users. In general, potential consumptive users could all be accommodated. But all demands for consumptive and instream users cannot be met at the same time. Pages 213 through 217 of the Draft EIS discussed the water reservation applications that are mutually exclusive; this addendum discusses the relation of new or amended applications to the original applications in that respect.

### UPPER YELLOWSTONE AND CLARKS FORK YELLOWSTONE SUBBASINS

The BLM minimum instream flow reservation is exceeded by the Fish and Game Commission request but would, by itself, leave sufficient water to satisfy consumptive use applications.

### BILLINGS AREA SUBBASIN

The relatively small amount of irrigation included in the BLM request would not affect other applications. However, the Bureau of Reclamation Buffalo Creek Offstream reservoir application would increase the conflict among instream and consumptive applications in this subbasin.

### MID-YELLOWSTONE AND KINSEY SUBBASINS

The Bureau of Reclamation offstream reservoir applications and the BLM application heighten the incompatibility of instream and consumptive use applications in these subbasins.

### TONGUE SUBBASIN

Supplemental information submitted by DNRC did not change its application or the incompatibility with other Tongue subbasin applications. The BLM minimum flow request is exceeded by the Fish and Game Commission instream application.

### POWDER SUBBASIN

Withdrawal of the DNRC application for Moorhead does not ease the incompatible nature of requests in the Powder Subbasin, since fulfillment of the conservation district applications there would require construction of a large water storage project. The BLM minimum flow request furthers the incompatibility of applications in that subbasin.

LOWER YELLOWSTONE SUBBASIN

Small increases in conservation district requests for irrigation water aggravate the incompatibility between consumptive and nonconsumptive use applicants.

## ALTERNATIVES AND ASSOCIATED IMPACTS

Under the Montana Water Use Act (Section 89-865 et seq., R.C.M. 1947), the Board may approve, deny, or modify requests for reservations of unappropriated water for existing and future beneficial use. The Board may, if it chooses, allocate all of the unused and unappropriated waters of the Yellowstone Basin. The Board may allocate water either to instream uses--such as maintenance of aquatic habitat, fish and wildlife uses, and water quality--or consumptive uses, such as irrigation, industrial, and domestic. In many cases there is an adequate supply of water to satisfy competing applicants, in some cases, not.

For each of 34 reservation applications, there are a number of conceivable alternatives. Any attempt to formulate and compare the impacts of all possible alternatives would quickly lead to an incomprehensible array of duplicative information. The Draft EIS presented a set of general alternatives, representing the range of options available and the impacts of those alternatives, with as much detail as possible.

It should be emphasized that the alternatives presented in the Draft EIS are not the only alternatives available. Because of the large range of options, the Board has great flexibility in choosing the final combination of reservations.

The alternatives considered in the Draft EIS were based on the four major uses to which the water would be put: irrigation, municipal and domestic consumption, energy conversion (thermal-electric generation, coal gasification), and instream flows. In addition, a "no action" situation was considered. Those alternatives still represent the range of options available to the Board; the new and amended applications have not materially changed the dimensions of the alternatives. Alternatives to the major new applications (Bureau of Land Management instream flow and the Bureau of Reclamation Hardin Unit and offstream reservoir sites) are considered in the Instream Flow Emphasis Alternative and Energy Emphasis Alternative, respectively, of the Draft EIS (pages 290-302 and 289, respectively).

## EFFECTS OF WATER RESERVATIONS ON PENDING WATER APPROPRIATIONS

## RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

## IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

See the Draft EIS (pages 309 through 328) for a discussion of these sections, since new and amended applications have not materially changed that analysis.

ERRATA

The Draft EIS contains errors, corrected below.

Page 245, paragraph 2 , should read:

Streamflow Alterations

The 90th percentile low flows would be the same as the instream flow provisions outlined above in addition to irrigation return flows. Median flows would be substantially reduced each month, while the median July flow would be reduced by over half. From August through November, median flows would be approximately the same as the 90th-percentile low flows.

Page 246. Delete Figure IV-1.

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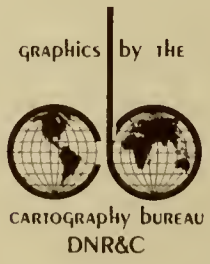
**and Conservation**

**Helena, Montana**

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